ELECTRICAL WORLD

A consolidation of Electrical World, Electrical Engineer and American Electrician

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What in the World

We used a different style for the editorial pages of our January 7 issue. This meant condensation, concentration and display to attract reader interest. We hope you liked the results.

●

As this new year starts questions and suggestions come to us. How is business going to be in 1933 dominates the inquiries and we wish we were expert crystal gazers so that we could predict the future. After reading all prognostications and year-end reviews, however, our answer remains the same — we don't know.

●

After sweeping onto the publicity stage with great acclaim, "Technocracy" is found to be an amateur performance. Even the conservative New York "Times" now follows our lead and ridicules the act. We are in style, however, and Mr. Morrow states some debatable but interesting principles in his article (page 60).

●

Dr. Compton predicted a future for electrostatic engineering recently. This is a highbrow name now, but the advent of surge tests for insulation introduces electrostatic engineering into practice. C. M. Foust makes some good suggestions (page 70).

●

We have been too busy to make New Year's resolutions. From our editorial point of view this period is shining with opportunities for service. We hope you will like our articles and ideas, but if you don't please tell us why.

750-volt d.c. railway electrification, Geneva, Switzerland

JANUARY 14, 1933

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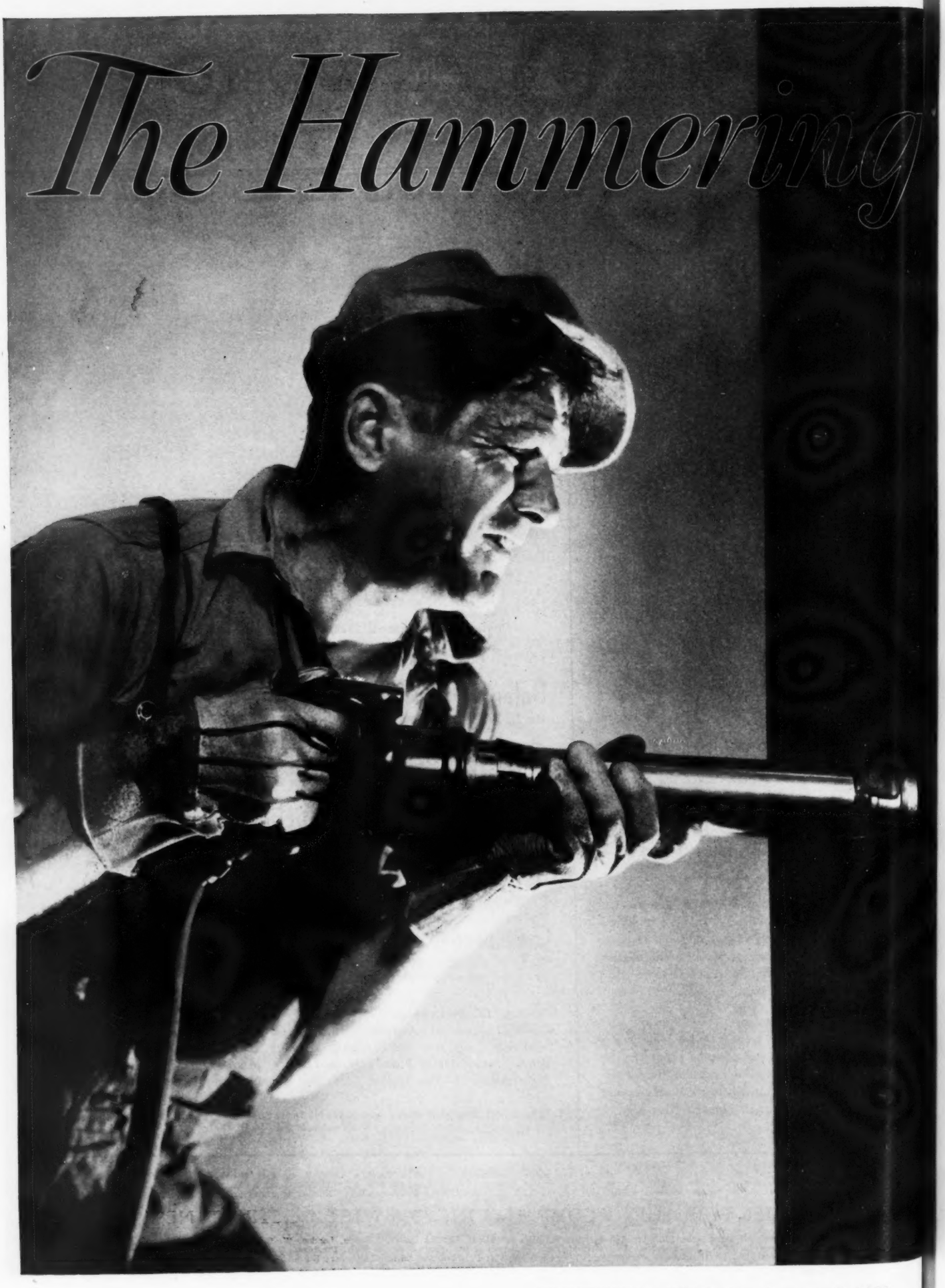
The Hammering



ELECTRICAL WORLD

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for the Week Ending

January 14, 1933

Edison Electric Institute Formed

National Electric Light Association dissolved — Utility memberships only — Officers have power to discipline member companies — Members must make commitments as to policies.

AFTER a great amount of discussion the leaders of the light and power industry have decided to dissolve the National Electric Light Association and to form a new organization called the Edison Electric Institute. George B. Cortelyou is president of the new organization and its trustees consist of leading holding and operating property executives. Only utilities will be represented in the new organization with company, individual and honorary memships. The Institute is expected to absorb both the N.E.L.A. and the Edison Association to form a single utility association.

The striking feature of the Institute is its constitution. Members must make definite commitment to follow the business principles laid down; the power of discipline is given the officers; definite requirements are made as to the filing of audited financial statements; individual membership must be approved by the companies with which the members are connected, and power is given the officers to investigate the business practices of member companies.

The objects of the Institute are to advance the art of business, collect and disseminate data and statistics and aid member companies in all ways that are in the interests of consumers, investors and employees. The business principles require annual financial statements certified by independent accountants, accurate and definite information for consumers, stock exchanges, stockholders and public dissemination, reasonable and fair charges for holding company services and, upon request, the answering of questionnaires of Institute officers.

The new organization is the outcome of an endeavor to unify the industry, give power to its leaders to protect its good name and to modernize its cooperative organization to meet present conditions to better advantage. Definite details of the dissolution of the present N.E.L.A. organization or acceptance of a merger proposal by the Edison Association have not yet been announced.

E.E.I. CONSTITUTION

ARTICLE I, NAME—The name of this association shall be the "Edison Electric Institute."

ARTICLE II, OBJECTS—The objects of the Institute shall be:

1. The advancement in the public service of the art of producing, transmitting and distributing electricity and the promotion of scientific research in such field.

2. The ascertainment and making available to the members and the public of factual information, data and statistics relating to the electric industry.

3. To aid its operating company members to generate and sell electric energy at the lowest possible price commensurate with safe and adequate service, giving due regard to the interests of consumer, investor and employee.

ARTICLE III, MEMBERSHIP — SEC. 1. There shall be four classes of members:

A. Operating company members, being operating electrical corporations engaged in the generation, transmission or distribution of electricity to the public.

B. Holding company members, being corporations which by virtue of their ownership of securities are interested in advancing the business of operating electrical companies in relation to the sale of electricity to the ultimate consumer.

The term "company members" as used in this constitution shall apply equally to operating and holding company members unless otherwise specified.

C. Individual members who shall be officers or employees of company members.

D. Honorary members.

SEC. 2. The president annually, subject to the approval of the board of trustees, shall appoint a membership committee consisting of five members. Applications for company membership subsequent to April 1, 1933, shall be referred to this committee, whose decision upon such applications when approved by the board of trustees shall be final. Any company or individual becoming a member of the Institute shall waive all rights to any assets of the Institute upon the termination of membership therein, either by voluntary withdrawal or expulsion. Each applicant company shall furnish to the membership committee such information with reference to its organization, properties, financial structure, affiliations and business practices as may be required by the membership committee from time to time.

SEC. 3. Individual members shall be officers or employees of company members elected by the membership committee and continued from year to year upon the written approval of the company member with which such individuals are connected.

SEC. 4. Honorary members shall be those who on account of their standing or qualifications in the opinion of the board of trustees and by its election are entitled to such honor. They shall have all the privileges of individual members, except the right to hold office.

SEC. 5. The membership committee, subject to the approval of the board of trustees and in accordance with resolutions which such board may from time to time adopt, shall have jurisdiction and authority to consider and investigate the business practices of any company member and to expel, suspend or take any other disciplinary action against any member guilty of a violation of proper or ethical business practices, or for failure to furnish information as required herein. Companies by virtue of becoming members of this Institute shall be deemed to have consented to the right of the Institute to impose such disciplinary action.

ARTICLE IV, BUSINESS PRINCIPLES—SEC. 1. The company members shall from time to time and not less than annually publish financial statements, including balance sheets showing gross and net income, operating expenses and surplus accounts, which statements shall be certified to by independent firms of certified public accountants who shall have audited the books of the company.

SEC. 2. All statements and data furnished to consumers, stock exchanges and stockholders; all information designed for public dissemination and all reports to governmental authorities shall be accurate and clearly indicate their source.

SEC. 3. All contracts between any member companies which involve the furnishing of management, supervisory, purchasing, construction, engineering or financing services to operating electric utility companies shall be so drawn and so operate in practice that the charges to the operating company shall be reasonable and commensurate with the value of the services rendered and the fair cost thereof to the company furnishing the services.

SEC. 4. Company members from time to time shall answer such questionnaires relative to their organization, financing, methods of operation and business practices as may be requested by resolution of the board of trustees.

ARTICLE V, DUES—SEC. 1. The annual dues of all classes of members shall be paid to the treasurer. They shall be in such amount and in accordance with such terms of collection as shall be fixed from time to time by the board of trustees.

ARTICLE VI, BOARD OF TRUSTEES—SEC. 1. The affairs of the Institute shall be governed by a board of not less than seven nor more than twenty-four trustees elected for a term of three years. This board shall be comprised initially of the following: William Chamberlain, B. C. Cobb, F. L. Carlisle, Alex Dow, George N. Tidd, John E. Zimmermann, Philip G. Gosler, to serve until the close of the annual convention in the year 1934, and C. E. Groesbeck, W. C. Baylies, Frank D. Comerford, Samuel Ferguson, George H. Howard, George O. Muhlfeld, Harry Bauer, to serve until the close of the annual convention in the year 1935, and George B. Cortelyou, Edwin Gruhl, A. F. Hockenbeamer, Thomas N. McCarter, John J. O'Brien, H. Hobart Porter, Herbert A. Wagner, James Simpson, to serve until the close of the annual convention in the year 1936. The board of trustees may from time to time enlarge the membership thereof up to but not exceeding twenty-four, and designate the term not exceeding three years which such additional members shall serve. Upon any vacany occurring by creation of additional members of the board, death, or resignation of a trustee, the trustees then in office shall fill such vacancy for the unexpired portion of the term.

SEC. 2. There shall be appointed by the president annually, with the approval of the board of trustees, an operating committee consisting of the president, the vice-presidents and eleven other members, who shall have charge of the general activities and business of the Institute, subject to the jurisdiction of the board of trustees. The president shall serve as chairman of this committee. The operating committee shall from time to time determine what other committees shall be created and define the scope of their authority. The members of such committees shall be appointed by the president.

SEC. 3. The trustees at their first regular meeting following the annual convention shall elect for a term of one year all officers, and shall have power to fill vacancies caused by death, resignation, disability or otherwise, or to remove any officer for good cause.

SEC. 4. The president, subject to the approval of the board of trustees, prior to the annual convention shall designate a nominating committee consisting of five members to make nominations at the convention, to fill vacancies in the board of trustees occurring by reason of the expiration of term.

ARTICLE VII, OFFICERS — SEC. 1. The officers of the Institute shall be a president, one or more vice-presidents, a treasurer and an executive secretary, who after the first year shall be members of the Institute but need not be members of the board of trustees.

SEC. 2. The president shall preside at all meetings of the Institute and perform such other duties as may be provided for by the board of trustees.

SEC. 3. The executive secretary shall be appointed by the board of trustees. Subject to such limitations as may be imposed by the operating committee he shall exercise general supervision and control of the routine activities of the Institute and shall have supervision over the employees, including their employment and discharge.

SEC. 4. The treasurer shall perform the duties assigned to him by the board of trustees. Subject to its approval he shall furnish a surety bond in such sum and with such terms as the board of trustees may prescribe from time to time.

ARTICLE VIII, ANNUAL CONVENTION—SEC. 1. Annual convention of the Institute shall be held in June of each year in such place and on such dates as the operating committee may designate, provided, however, that the committee upon notice to all members on or before May 15 of any year may fix any other date for said annual convention.

SEC. 2. Twenty company members shall constitute a quorum for the transaction of business.

SEC. 3. At the annual convention there shall be elected trustees for a term of three years to fill vacancies caused by the expiration of term.

SEC. 4. The right to vote on all matters shall be solely by company members. Voting by proxy shall not be allowed.

ARTICLE IX, PERMANENT OFFICE—SEC. 1. The permanent office of the Institute shall be located in the city of New York.

ARTICLE X, SPECIAL MEETINGS—SEC. 1. Special meetings of the Institute may be held upon the authority of the board of trustees at any time, upon thirty days' notice to every company member, stating the date and place of such meeting and the business to be transacted.

ARTICLE XI, AMENDMENTS — SEC. 1. Amendments to the constitution may be adopted from time to time upon the recommendation of the board of trustees. A two-thirds vote of the company members present at either a special or annual meeting of the Institute shall be necessary for the adoption of any amendment.

Edison Electric Institute Officers for 1933

George B. Cortelyou, President.
William J. Hagenah, Vice-president.
Bernard F. Weadock, Executive Secretary.
Edward Reynolds, Jr., Treasurer.

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Oil-Filled Cable Service Without Electrical Failure

No electrical failures have ever occurred in the 340 mile-years of operation which cable of the oil-filled type has achieved. Furthermore, though it was necessary to remove sixteen lines of such cable from service in 1931, a total of fifteen times per 100 miles per year to repair oil leaks, the repairing was in all cases done at convenient times. This was brought out in the report, just issued, of the underground systems committee of the National Electric Light Association, which also points out that the minor troubles peculiar to such cable are decreasing.

Other conclusions reached in the report, which covers all cable operations for 1931, are: At least 23 per cent of all joint failures are due to inferior workmanship; about 9 per cent of all failures and anticipated failures were caused by wear at duct mouths; of the 113 inherent failures due to defective insulation only 5.3 per cent took place in cable less than three years old, 25.7 per cent in cable three to ten years old and 69 per cent in cable more than ten years old; only five of the total 222 sheath repairs were necessitated by mechanical damages either during or after installation, and only 13 per cent of the failures due to manufacturing defects occurred in the first two years, during which the manufacturer agrees to replace the cable.

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Maltbie Willing to Extend Municipal Plant Services

Concluding it reasonable either that the Niagara, Lockport & Ontario Power Company cannot supply certain communities at rates as low as those charged by a municipal plant or that the company can reduce rates in other communities, and assuming the first of the alternatives to be correct, Chairman Maltbie of the New York State Public Service Commission has gone on record as favoring the extension of municipal plants under certain conditions.

Mr. Maltbie favors a recommendation (from the state Legislature) which will authorize municipal plants to supply electricity beyond their immediate boundaries subject to the approval of the Public Service Commission, so that every locality may secure the lowest possible rates for utility services.

Commissioner Burritt, concurring with Chairman Maltbie, stated: "If municipal plants limit their services strictly to city lines and do not extend their benefits to the immediate surrounding trade areas they will not be likely to build up their trade areas or acquire and retain the good will of the surrounding population."

The situation arose in connection with the filing of a new rate schedule, effective January 1, for portions of the towns of Busti and Keantone. The municipal plant is that at Jamestown. The commission, under existing laws, did not feel free to act in accordance with its acceptance of equities.

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Russian Industry Now 73 per Cent Electrified

Accepting the recent official statement of the Trade Delegation of the Union of the States of Soviet Russia in Great Britain as the last word in electrification statistics about conditions in Russia, remarkable results appear to have been achieved.

The original plan drawn up in 1920 called for the building of 30 new power plants with a total capacity of 1,500,000 kw. within a period ranging from ten to fifteen years. The output of these combined with that of pre-revolutionary stations would provide for a capacity of 1,750,000 kw. for all the regional plants in the Union. This plan was exceeded by the end of 1931, when the total of regional plants equaled 2,220,000 kw. and the capacity of all plants amounted to 4,050,000 kw. Thus 74 per cent of the Five-Year Plan had been fulfilled, as the plan scheduled a total output of 5,500,000 kw. in 1932-33. The accompanying table demonstrates clearly the rapid progress made.

Whereas the output of all plants in 1931 was 5½ times the pre-war figure, that of the regional plants was over fifteen times. The regional plants displayed a further large increase in output last year, amounting in the first ten months to 37 per cent. The network of regional stations is constantly being extended. In 1930 it already embraced over 70 power plants, as compared with eighteen in 1927.

Capacity, Output and Electrification, 1912-1931

	1913	1925	1928	1931
Capacity (at end of year, kw.)—				
All plants	1.01	1.38	1.88	4.05
Regional plants	0.17	0.37	0.63	2.22
Output (thousands of millions of kw.-hr.)—				
All plants	1.95	2.93	5.00	10.80
Regional plants	0.43	0.94	2.00	6.65
Electrification of industry (per cent)	no data	55.0	59.0	73.2

Capacity—	Ratio of 1931 to 1913	1928 (per cent)
All plants	401	294
Regional plants	1.305	355
Output—		
All plants	555	360
Regional plants	1.543	333
Electrification		124

Electrification of industry, which reached over 73 per cent in 1931, has constituted a prime factor in its technical reorganization. In 1925-26 the U.S.S.R ranked eleventh in output of electric power, but this year it will rank third or fourth.

Most recent word from Russia indicates that though energy output is steadily rising some snag has arisen in the plans of the Soviets, for domestic customers in Moscow have been ordered to curtail their use of energy in the next four months by 44 per cent under penalty of a tripled rate for all that consumed.

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Pennsylvania Inquiry Barred; Committee Asks Firmer Law

By permanently restraining the Pennsylvania utility investigating committee from spending any of the $100,000 appropriated by the special session of the Legislature last year, the Dauphin County Court has prevented the committee investigating the state Public Service Commission from continuing hearings or incurring any expense unless the present session makes a new appropriation to finance the inquiry. The decision was given in a taxpayer's suit brought by Ira Jewett Williams, Philadelphia attorney and counsel for former Public Service Commissioner James S. Benn. A temporary injunction was obtained about a month ago (ELECTRICAL WORLD, December 10, page 771). The court in this recent decision sustained the claim that the appropriation and the investigation were illegal in that they did not come within the scope of Governor Pinchot's call for the special session. Oliver K. Eaton, committee counsel, said the injunction would be appealed to the state Supreme Court.

Committee recommendations

Although shorn of its power by this action of the court, the committee submitted a report to the Senate, outlining changes which it believes should be made in the public service act and in the powers of the Public Service Commission. It suggested legislation eliminating evils and abuses incident to the public utility holding company system; preventing overcapitalization of utilities and furthering control of their issuance of securities; repealing a section of the 1927 securities act which now exempts utility employees from obtaining licenses to sell securities; requiring utilities to maintain adequate depreciation reserves and intrusting the enforcement of this duty to the Public Service Commission; regulating sales of appliances and equipment by utilities; requiring that utility rates shall not be increased before the Public Service Commission has had a chance to pass upon their reasonableness; relieving complainants of undue burdens in cases before the Public Service Commission and on appeal to the courts, by providing legal and engineering assistance; requiring Public Service Commissioners to devote their entire time to duties of office, and to provide that proceedings before the commission shall be disposed of promptly; eliminating payment of service charges in advance in certain instances; eliminating the imposition of excessive penalties, ready-to-serve and rental charges on the part of certain types of utilities and regulating telephone company charges for use of hand instruments.

A Few Months of "Dolce Far Niente"

Events of the week have but added to the prevailing confusion of the public mind. The appalling inability of Mr. Roosevelt and his party leaders either to agree or to agree upon what they agreed at the conference on government economy measures has not been helpful. The unprecedented action of the Federal Reserve Board in announcing its future open-market policy and virtually guaranteeing the continuance of the cheap money program which has already led to system bank holdings of $1,851,000,000 in government bonds, creating a highly artificial market, is less reassuring than disturbing. The first telltales of the familiar round of budget, bonus, inflation and war debt rationalizing to be resumed about where it all stood a year ago have appeared. Public works construction, that much-praised savior of the unemployed, has about run its course and left little but increased debts to show for the struggle.

Figures of the week are virtually meaningless as to volumes; somewhat encouraging as to prices. The former but refer to the last desperate struggles of the dying year; the latter may foretell an encouragement whose greatest strength will consist in resistance to further declines.

Not the glamorous days of 1926-1929 but those directly ahead constitute the true new era and industry has some radical acceptances to acquire before becoming ready to face the new day. As it is unlikely that for some time to come the construction industry or the railroads or even the automobile manufacturers will be purchasing basic supplies in such volumes as greatly to affect a resumption of trade in that field, it is to the consumer goods industries (off only 14 per cent in 1932 as compared with 1931 so far as retail dry goods sales are concerned) and to the service industries, today only partially or not at all developed, that one must look for opportunities in the months just ahead. An interval of promise for the resourceful who are not too set in their ways to start anew perhaps from virtually a beginning.

Kansas Asks Voluntary Cuts

Asking for voluntary rate reductions of 15 to 25 per cent, a letter has been sent to 346 utilities in Kansas by the state Public Service Commission. The letter, which went to five electric, 32 gas and 309 telephone companies, points out the physical impossibility of holding 346 separate hearings to determine what the rates should be. The companies are requested to forgo dividends if necessary in order to reduce charges substantially, and thus to come into line with the "trend of the times" and the reductions made by 82 Kansas utilities in the past two years. The members of the commission expressed the belief that the utilities would gain much more in the good will of their customers by making these voluntary reductions than would be lost in decreased revenues.

Coming Meetings

National Electrical Manufacturers' Association — Midwinter meeting, New York, Jan. 16-19. A. W. Berresford, 570 Lexington Ave., New York.

American Institute of Electrical Engineers—Winter convention, New York, Jan. 23-27. H. H. Henline, 33 West 39th Street, New York.

Great Lakes Division, N.E.L.A.—Fifth annual sales conference, Chicago, Feb. 16-17. T. C. Polk, 20 No. Wacker Drive, Chicago.

National Accounting Section, N.E.L.A. Committee meetings, Chicago, Feb. 20-21. A. J. Marshall, 420 Lexington Ave., New York.

New England Division, N.E.L.A.—Engineering Section, Boston, Mass., March 2-3. O. A. Bursiel, 20 Providence St., Boston.

Oklahoma Utilities Association—Oklahoma City, Okla., March 7-8. E. F. McKay, 1020 Petroleum Bldg., Oklahoma City, Okla.

National Sales Section, N.E.L.A.—Committee meetings, Chicago. March 21-23. A. J. Marshall, 420 Lexington Ave., New York.

A.I.E.E. Winter Convention Program

DURING the week of January 23-27 the American Institute of Electrical Engineers will hold its winter convention in New York, patterned along familiar lines and including the usual features of Edison medal presentation, smoker, dinner dance and inspection trips to nearby points of electrical engineering interest. The program will open at 2 p.m. on Monday with the presidential address of H. P. Charlesworth and the presentation of the Alfred Nobel prize to Frank M. Starr.

Other events on the Monday program will be sessions devoted to AUTOMATIC STATIONS, during which pipe line pumping problems, condenser discharge principles in central station control, direct-selection supervisory control and improved power supply for street railway service will be covered, and ELECTRIC WELDING, during which studies of arc discharge, high-frequency generators, transients, vapor streams and performance will be discussed.

Tuesday topics include: COMMUNICATION, with papers on requirements of railroads, signaling and train control and outlines of practices on the Pennsylvania, Reading and Baltimore & Ohio; ROTATING ELECTRICAL MACHINERY, with discussions of the low-frequency, self-exciting commutator generator, factors affecting temperature rise in armatures, parallel operation of a.c. generators and synchronous motor pulling-into-step phenomena; TRANSPORTATION, with reference to the application of air conditioning to railroad passenger cars, calculation of single-phase series motor control characteristics, operating data on the Cleveland Union Terminal electrification, power supply for main line railway contact systems and simplified speed control for single-phase locomotives; SOUND MEASUREMENT, an informal meeting.

Wednesday topics will be: EDUCATION and INSULATION CO-ORDINATION, with reports on progress in impulse testing of commercial transformers, factors influencing the insulation co-ordination of transformers, protection of rotating machines against traveling-wave voltages, recent development in high-current mercury-arc rectifiers and the new synchronous-mechanical rectifier-inverter.

Thursday papers cover: LIGHTNING, with recommendations for impulse voltage testing, lightning experience on 132-kv. lines of the American Gas & Electric System, impulse and dynamic flashover studies of 26-kv. wood-pole construction and operating experience with wood utilized as lightning insulation; ELECTROCHEMISTRY and ELECTROMETALLURGY, with address on increasing application of electricity to chemical processes, light sensitive process control, resistance of storage battery separators and resistivity and viscosity of battery electrolytes and high conductivity oxygen-free copper; INSTRUMENTS and MEASUREMENTS, covering a standard of low power factor, a bridge for precision power-factor measurements on small oil samples, skin effect in rectangular conductors and laboratory measurement of impulse voltages; INDUSTRIAL APPLICATION, with circuit breaker protection for industrial circuits, variable voltage equipment for oil well drilling and recent developments in electronic devices.

Friday closes the meeting with: PROTECTIVE DEVICES, involving the use of communication facilities in transmission line relaying, protection of electrical apparatus, a sequence relay for network protectors and phase sequence relaying; SELECTED SUBJECTS, higher steam pressures and temperatures and empirical equations for the magnetization curve and RESEARCH and APPLIED ELECTRONICS with the dielectric losses in impregnated paper, applications of harmonic commutation for thyratron converters, a new method for initiating the cathode of an arc and capacitance and loss variations with frequency and temperature in composite insulation.

Insull Debt Extension Attack Continued

Purpose of the debt extension agreement whereby seven banks in New York and Chicago and the General Electric Company enabled Insull Utility Investments, Inc., to continue four months after December, 1931, before letting it go into receivership, has been further questioned at the hearings in New York before John E. Joyce, bankruptcy referee (ELECTRICAL WORLD, December 24, page 834).

On the ground that the lenders knew Mr. Insull to be insolvent when they took his last collateral and that they organized an informal moratorium which lasted long enough to carry them outside the legal limit for the transfer of assets before a bankruptcy, Lewis F. Jacobson, counsel for the debenture holders, demanded that Gerard Swope, as president of the General Electric Company, surrender to the receivers of Insull Utility Investments the collateral held as security for the loan of $500,000. Mr. Swope refused. He admitted that he learned from Mr. Insull, before making the loan, that stocks which had cost $188,000,000 already had been pledged out of the $250,000,000 contents of the holding company portfolio—that is, 75 per cent—but he denied all knowledge of a clause in the $60,000,000 outstanding debentures purchased by some 80,000 investors under which the holding company convenanted not to pledge more than 50 per cent of the current market value of its assets.

Up to the present not one banker has admitted knowing the holding company had widely advertised this protective clause of the debentures.

More receiverships

While this was taking place in New York suit for the appointment of a receiver for the $10,000,000 Commonwealth Light & Power Company, public utility holding company and a subsidiary of the Middle West Utilities Company, was filed in federal court in Chicago by Edward N. Hurley and Charles A. McCulloch, receivers of Middle West. The petition states that Commonwealth owns outright the Inland Power & Light

Corporation, which is in receivership, and the Missouri Edison Company, which is not. The bill states that the company, although unable to meet the interest payments, is nevertheless solvent and has substantial equities which will be of great value to Middle West under the operation of an equity receiver. Commonwealth consented to the appointment of a receiver. Receivers have been appointed by the Delaware Court of Chancery following a default of interest due January 1 on the $11,680,900 of outstanding general lien bonds, of Northeastern Public Service Company general lien and collateral trust 5½ per cent gold bonds due in 1961. Control of Northeastern Utilities, which controls Northeastern Public Service, lies in the National Electric Power Company.

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Doherty Wins in Kansas in 20-Year, 30-Cent Gas Case

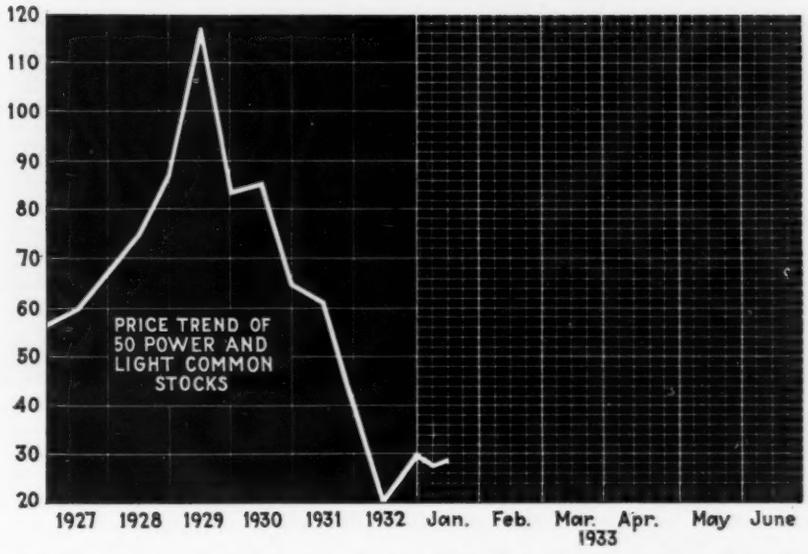
Permanently enjoining the Kansas Public Service Commission from enforcing the 30-cent gas rate set by it and holding that under that rate the company could not make a fair return on its investment, a three-judge federal court has held invalid the schedule imposed upon the Cities Service Gas Company for natural gas supplied by it in the state. The court did not set a rate but upheld the right of the regulatory body to fix a "fair and reasonable rate" for gas.

This decision, which involves points of interest to utilities offering other types of service, has brought to a close, unless appealed and reversed, a twenty-year fight by the Kansas commission to regulate gas rates.

The decision lowered the Doherty valuations $23,000,000 to $83,000,000 and found that the application of the 30-cent rate would earn but 4.7 per cent on the investment. The court held that the company is entitled to earn 8 per cent. The opinion upheld the commission's findings in disallowing the 1¾ per cent management charge paid by subsidiaries to Henry L. Doherty & Company.

The holding of gas leases, disallowed by the commission, was upheld by the court. Attorneys for the commission indicated they would appeal to the United States Supreme Court.

Utility Stock Market Firm



Strength was apparent in the electric light and power stocks during the past week, prices bringing the *Electrical World* index up to 28.7, as compared with 27.7 recorded for the first week of January.

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Current Earnings Reports of Electric Light and Power Companies

Operating Companies

	1932	1931	Per Cent Increase	Operating Ratio 1932	Operating Ratio 1931
Alabama Power (Year ended October 31)					
Gross earnings	$15,890,718	$17,852,963	—11.0	48	48
Net earnings	8,237,414	9,244,619	—10.8	..	..
Net balance	1,296,670	2,529,176	—48.7	..	..
Duquesne Light (Year ended November 30)					
Gross earnings	25,450,803	27,995,003	— 9.1	43	42
Net earnings	14,532,064	16,299,523	—10.8	..	..
Net balance	10,747,623	13,087,505	—17.8	..	..
Georgia Power (Year ended October 31)					
Gross earnings	22,890,819	25,299,444	— 9.5	49	54
Net earnings	11,625,012	11,648,258	Negl.	..	..
Net balance	2,503,648	2,982,114	—16.1	..	..
Kansas City Power & Light (Year ended November 30)					
Gross earnings	14,800,878	14,785,184	Negl.	60	59
Net earnings	5,921,256	6,040,774	— 2.0	..	..
Net balance*	4,172,788	4,493,915	— 7.1	..	..
Louisville Gas & Electric (Year ended November 30)					
Gross earnings	9,977,767	10,803,332	— 7.7	56	53
Net earnings	4,369,196	5,106,841	—14.3	..	..
Net balance	1,713,706	2,349,234	—27.2	..	..
Northern States Power (Del.) (Year ended November 30)					
Gross earnings	32,551,071	33,997,111	— 4.3	60	57
Net earnings	13,132,386	14,672,420	—10.5	..	..
Net balance	2,264,992	3,940,803	—42.5	..	..
Southern California Edison (Year ended November 30)					
Gross earnings	37,464,662	40,834,708	— 8.2	31§	33§
Net earnings§	25,942,472	27,292,420	— 5.0	..	..
Net balance†	18,866,097	20,358,887	— 7.2	..	..

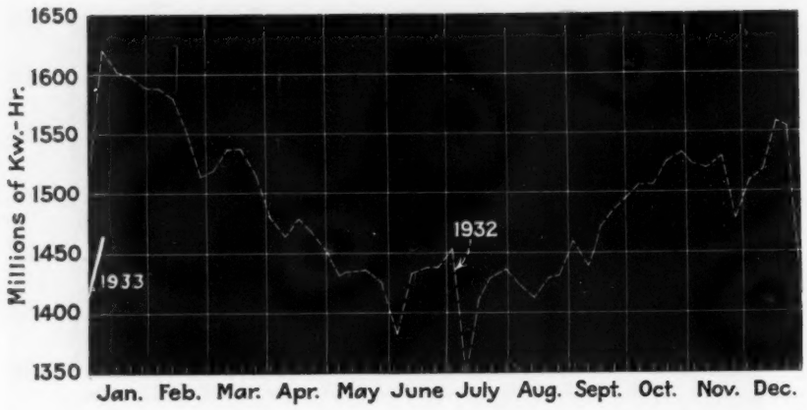
Holding Companies

	1932	1931	Per Cent Increase	Operating Ratio 1932	Operating Ratio 1931
American Power & Light and subsidiaries (Year ended October 31)					
Gross earnings	$77,249,796	$85,435,704	— 9.5	53	53
Income from subsidiaries	12,423,008	18,364,462	—32.3	..	..
Net balance	611,160	7,074,652	—91.3	..	..
Commonwealth & Southern and subsidiaries (Year ended November 30)					
Gross earnings	116,075,948	131,010,092	—11.5	53	54
Net balance	5,528,599	13,753,186	—60.0	..	..
Electric Power & Light and subsidiaries (Year ended October 31)					
Gross earnings	74,467,784	81,830,991	— 9.0	58	57
Income from subsidiaries	7,480,297	12,093,312	—37.4	..	..
Net balance+	535,293	5,025,740	—89.5	..	..
National Power & Light and subsidiaries (Year ended October 31)					
Gross earnings	72,606,060	78,729,027	— 7.8	60	61
Income from subsidiaries	10,035,900	12,228,390	—17.9	..	..
Net balance	7,220,766	9,377,108	—23.0	..	..
Philadelphia Company and subsidiaries (Year ended Novenber 30)					
Gross earnings	49,614,085	58,228,945	—14.8	64	61
Net balance	5,402,429	11,224,710	—51.7	..	..

+ Balance available for second preferred and common stocks.
* Balance available for preferred and common dividends.
§ Operating expenses do not include deductions for depreciation.
† Balance available for preferred and common dividends and depreciation.

Gross earnings—(Operating Companies) Gross operating revenue. (Holding Companies) Gross operating revenue plus other income. Net earnings — Earnings after deduction from gross earnings of operating expenses taken to include taxes, depreciation, maintenance, operating, etc. Income from subsidiaries — Balance available from income of subsidiaries for holding company. Net balance — Balance available from income for common stock dividends.

Output Rises After Holiday



Energy production by central stations during the week ended January 7 was 1,460,639,000 kw.-hr., the National Electric Light Association announces. Comparison with operations a year ago for the past three weeks combined shows a decrease of 5.9 per cent, against 6.7 per cent for the week of December 17. Regional decreases for the same three weeks (week of December 17 in parentheses for comparison) were: Atlantic seaboard 4.6 (3.7) New England alone 3.8 (5.6), Central industrial 8.5 (8.2), Pacific coast 5.0 (5.9).

Weekly Output, Millions of Kw.-Hr.

Week Ended	1933	1932	1931	1930
January 7.....	1,461	1,619	1,714	1,816
	(1932)	(1931)	(1930)	(1929)
December 31.....	1,415	1,524	1,597	1,680
December 24.....	1,554	1,565	1,617	1,638
December 17.....	1,563	1,676	1,770	1,860
December 10.....	1,519	1,672	1,748	1,841

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Public Utility 1932 Census to Be Taken by Government

In connection with its quinquennial census for the year 1932 of electric light and power, electric railway and telephone and telegraph enterprises the Department of Commerce is said to plan the most comprehensive survey of the public utility industry ever undertaken by the government. This census, taken every five years, will provide the first official information since 1927 of the extent of the volume of electric power transmission, wire and wireless communication, and electric railway transportation, including buses operated in connection with electric railways. Preliminary work on the census has nearly reached its final stages, actual canvassing awaiting only the return from the Government Printing Office of certain schedules to be used in obtaining data for the survey.

Two schedules will be used for the electric light and power industry, one to consolidated, commercial and municipal systems doing an annual volume of business of $50,000 or more and the other to those under $50,000. In conducting its census the bureau will check its information with other government agencies, including the Interstate Commerce Commission, the Federal Trade Commission, the Geological Survey and the Department of Commerce. For several months the Bureau of the Census has been in communication and conference with various utility associations and other interested organizations which are co-operating in procuring for American industry this essential information regarding the public utility industry.

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Jap Lamps, Though a Menace, Affected Industry Little

New light on a controversial question was cast last week by an authorized statement by the Hygrade Sylvania Corporation, which indicates, in discussing the outlook for the current year: "The lamp business was normal in 1932 and we expect it to remain so in 1933. The number of lamps used by the country in 1932 was practically the same as in 1931, and we expect no change in 1933. The dollar value was slightly lower in 1932 and this trend will probably continue through the year.

"The chief menace to the industry is the importation of cheap lamps from Japan. The importations have not seriously affected our industry. Nevertheless the threat is a real one, which must be met through legislative protection or public education."

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Electrified Irrigation for Egypt

Primitive irrigation methods will be replaced by modern electrified systems when the program undertaken by the Egyptian government has been completed. The project, in conjunction with heightening Aswan Dam (ELECTRICAL WORLD, December 10, page 775), comprises a number of electrically driven pumping stations supplied with energy from a power station at Idfu by means of overhead transmission lines. Transmission will be at 33,000 volts, three-phase, later to be raised to 66,000 volts. The power and pumping stations will be finished in 1933.

▼

South African Engineers Plan Lightning Study

Extensive studies of lightning are to be made in South Africa, which has more lightning and a higher mortality from this cause than any other country in the world, according to W. H. F. Tredre, technical secretary main committee, South African Institute of Electrical Engineers, Johannesburg. A committee, under the chairmanship of Dr. O. R. Randall, Witwatersrand University, has been organized, on which are such members as Bernard Price, general manager Victoria Falls & Transvaal Power Company; Dr. B. F. J. Schonland, Dr. Eric Halliday and other engineers whose daily experiences are of value.

To avoid unnecessary duplication of work already done by investigators elsewhere and enable the South African studies to supplement the mass of information internationally available the committee is seeking any bibliographies available on the subject.

During the current lightning season, Mr. Tredre reports, data on the progress of storms are being collected from 3,500 observers throughout the Union. Unique photographs have been obtained and several Boyes cameras are being constructed.

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Canadian Energy Output Shows Marked Gain

Swinging up 4 per cent as compared with October, November production of Canadian central stations for the first time in several years surpassed that of the corresponding month of the preceding year. The total as reported by the Dominion Bureau of Statistics was 1,447,857,000 kw.-hr. Water power contributed 1,416,704,000 kw.-hr. of this. The increase is the more noteworthy because this is the first time since 1929 that November output has exceeded October.

The gain occurred chiefly in Quebec, which produced 823,035,000 kw.-hr., against 763,577,000 kw.-hr. in October and 731,014,000 kw.-hr. a year ago. Smaller gains are reported for the other provinces except Ontario, which dropped to 333,195,000 kw.-hr. from 348,530,000 kw.-hr. in October. It would therefore appear that the rise indicates primarily an increase in the paper industry.

Distribution Costs Low at Chicago Exposition

Simplification of arrangement and design have been important factors in reducing the cost of the electrical distribution at Chicago's 1933 Century of Progress Exposition to about one-fifth of the preliminary estimates of close to $1,000,000. The maximum demand of the fair will probably be in the neighborhood of 25,000 kw. Approximately 20,000 kw. of distribution transformer capacity is already installed. Two 12,000-volt cables from the Commonwealth Edison system will feed into the main substation located in the stadium structure of Soldiers Field. From this point radial feeders at 4,000 volts Y in cables of from 350,000-circ.mil to No. 2/0 run out to transformer vaults in the main groups of various exposition buildings.

The cables, 140,000 ft. total ultimately, of which about 100,000 ft. is now installed, are pulled into 4-in. uncreosoted wood pump log conduits. The latter are laid about 20 in. below the surface without any concrete envelope or other holding or protective means. The largest runs consist of nine ducts, the square conduits simply laid on each other in three rows. Care is taken that the duct runs lay mostly in uncovered areas; that is, under lawns, for example, where sprinkling will keep the soil moist and assist in heat dissipation. Distances between manholes vary from 400 to 600 ft.

Transformer installations are being made in the distribution vaults for labor costs of $160 for a 150-kva. bank and $180 for 200 kva., with labor at the Chicago union scale. The vaults contain no oil circuit breakers, disconnecting switches or metering equipment. The 4,000-volt feed simply fans out from a pothead to disconnect type fuses mounted on the end of the pipe rack which extends over the transformers to support the primary and secondary buses. There will be about 40 transformer vaults in the installation.

In addition to the savings realized by so simplified a system, costs will be further reduced by the sale of salvaged equipment and materials when the fair is over. The cable, rented from the Commonwealth Edison Company, will be returned, but the wooden duct will be left in the ground and the wooden manholes filled in.

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New York Metal Prices

	Jan. 3, 1933 Cents per Pound	Jan. 10, 1933 Cents per Pound
Copper, electrolytic	5.00	5.00
Lead, Am. & S. R. price	3.00	3.00
Antimony	5.40	5.45
Nickel ingot	35.00	35.00
Zinc, spot	3.475	3.45
Tin, Straits	22.75	22.50
Aluminum, 99 per cent.	23.30	23.30

Major New Construction This Week

Philadelphia Electric Company has secured building permit for plant addition. Cost $500,000.

Electric refrigerating equipment, motors, transformers, conduit lines, conveyors, etc., will be installed in market to be constructed by Dallas Farmers Public Market Company, Dallas, Tex. Cost $187,000.

Heavy-duty motors, electric hoists, refrigerating machinery, conveyors, etc., will be required by Phoenix Brewing Association, Phoenix, Ariz. Cost about $130,000.

Delaware Electric Power Company, Wilmington, Del., has arranged an appropriation of $138,171 for extensions and improvements in 1933, chiefly for substations, transmission and distributing lines.

Bond issue of $500,000 is being arranged by Durham, N. C., for a city-owned electric light and power plant and distributing system.

Connecticut Electric Service Company, Hartford, Conn., has arranged an appropriation of $2,047,738 for extensions and improvements in 1933, including the installation of new equipment.

Motors, machine drives, electric hoists, electric refrigerating equipment, conveyors, etc., will be installed in the plant of the Atlantic City Brewing & Ice Company, N. J. Cost over $200,000.

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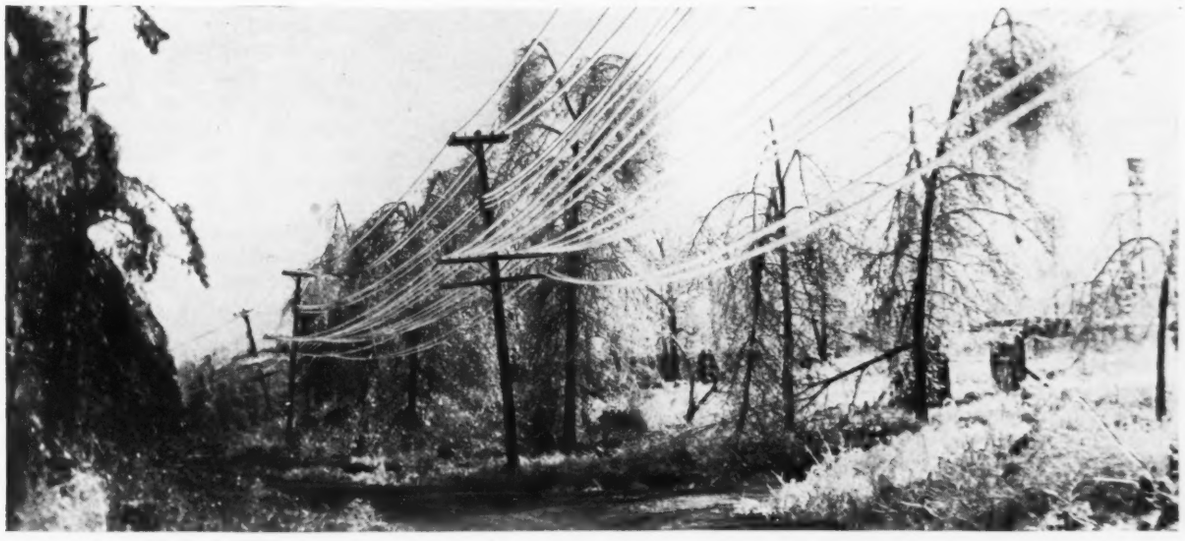
When Boreas Hit the Sunny South



On December 15 a good old-fashioned sleet storm hit below the Mason and Dixon line and transportation, communication and energy supply took the count (ELECTRICAL WORLD, December 24, page 833, and December 31, page 872). Alabama Power has just completed a survey of the damage done. There were more than 40 cases of transmission trouble involving 44- and 110-kv. lines. All lines of communication failed and the company used radio station WAPI to notify division offices and call in former lineman employees. Precipitation was in the form of fine rain, which froze on striking solid objects. The glaze on conductors was an inch thick in places with 12 to 15-in. icicles.

Service interruptions ranged from 36 to 48 hours in the more remote and hard-hit sections. According to E. W. Robinson, superintendent of distribution and transmission, it will be several months before permanent repairs are completed. Assailed on a Thursday, practically all the transmission circuits had been restored to operation on the following Tuesday. The scene illustrated is that at Gadsden, Ala., on the day following the storm.

Pennsylvania R.R. Electrification

Electric passenger train service over the Pennsylvania Railroad between New York and Philadelphia will be started early this year, M. W. Clement, vice-president in charge of operation, has announced. The overhead wire construction has been completed and the first test train will be run within a few days. The change of engines from electric to steam, and vice versa, will be made for through East and West trains at Paoli, on the main line, and for trains to and from Washington and the South at Wilmington, Del.

▼

New Hydro Plant for Radford, Va.

Voters of Radford, Va., have voted approval of the city Council's proposal to issue municipal bonds to the amount of $150,000 to finance the construction of a hydro-electric plant on Little River. Preparations for the construction of the plant at the confluence of Little and New Rivers are expected to begin immediately. The bonds will be offered in the open market and the Reconstruction Finance Corporation, at the suggestion of which the interest rate was fixed at 5 per cent, will probably be a bidder.

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Eldorado Court Dark Two Weeks

Ordering electric lights to be turned on again, newly sworn-in Judge G. S. Tatum has put an end to two weeks of illumination by candles, flashlights and lanterns in Union County's courthouse at Eldorado, Ark. (ELECTRICAL WORLD, December 31, page 872). Service had been discontinued due to non-payment of bills. In refusing to issue warrants for their payment, the county clerk called attention to Amendment No. 11, which provides that no county may spend more than its income in a year.

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Frigidaire Returns to One-Year Guarantee

Announcement has been made by the Frigidaire Corporation that, effective January 1, it has returned to a one-year guarantee on all types of refrigerating equipment built in its factories. "Unusual competitive conditions," President E. G. Biechler said, "were responsible for the appearance of the long-time guarantee in the refrigeration field. . . . In starting to sell our products on a one-year guarantee we feel that the customer will be better served, that unsound business practices will cease and that our distributing and dealer organization will progress as a direct result." A survey taken by the corporation of the public utility companies which merchandise its products shows that while in 1931 these companies obtained 11.5 per cent of their entire total additional connected load from electric refrigeration, the percentage jumped to 16.4 in 1932.

▼

St. Charles Votes Down Municipal

At a special election on January 5 the proposal to issue $300,000 in bonds for a municipal plant and distribution system was defeated by the voters of St. Charles, Mo. Mayor W. S. O'Neal has expressed the belief that another election on the proposal will be held at an early date. St. Charles is now supplied with electric current by the Union Electric Light & Power Company, whose present franchise expires in March, 1934. The company has sought a new franchise, promising a reduction in rates.

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Nothing in the world can take the place of persistence. Talent will not; nothing is more common than unsuccessful men with talent. Genius will not; unrewarded genius is almost a proverb. Education will not; the world is full of educated derelicts. Persistence and determination alone are omnipotent. The slogan "Press on" has solved and always will solve the problem of the human race.

CALVIN COOLIDGE.

[Mr. Coolidge, by ancestry and environment close to the elementary faith and works of individualism, knew the amazing values of simple living and the will to do. Not government, not blocs, not favoritism can be looked for as depression cures. Only the courage and work of every one will clear the way.]

▼

Largest Plant in Far East Completed

Said to be the largest hydro-electric power installation in the Far East, the 200,000-hp. project on the Fusenko River, Korea, has recently been completed. The Fusenko has been dammed to provide a storage of 25,000,000,000 cu.ft. A pressure tunnel 17 miles long leads the water to a surge chamber on the far side of a mountain range. From the surge chamber a pressure pipe leads to the power station. The plant comprises four Pelton horizontal single-wheel turbines with two nozzles, directly coupled to the generators, and operating under a head of 2,180 ft. Official tests showed a maximum efficiency of nearly 92 per cent.

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Missouri Utility Denied Rehearing

Petition of the Missouri Utilities Company for a rehearing upon the state Public Service Commission's recent order for reductions in electric rates in the southeast Missouri section served by the utility (ELECTRICAL WORLD, November 12, page 648) has been denied. The reductions were estimated by the commission to total approximately $100,000 annually.

Modesto Seeks Additional Properties

Modesto Irrigation District has asked the California Railroad Commission to fix the compensation to be paid for the electric distribution system of the Sierra & San Francisco Power Company, subsidiary of the Pacific Gas & Electric Company, within the district. According to the petition, the power company serves a portion of the area of the Modesto district and is a competitor of the system owned by the district, particularly in the city of Modesto.

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Oswego Plants to Niagara Hudson

Consummation of a contract between the Niagara Hudson Power Corporation and the Oswego Falls Corporation, effective January 1, gives the utility company virtual control of power resources of the Oswego River from Phoenix, N. Y., to the mouth of the river. The hydro-electric plants involved in the transaction were the main Oswego Falls power project, the old American Woolen Mills plant and the Gage Mill plant, all located in Fulton, N. Y. Niagara Hudson and affiliates now control six plants in Fulton, one at Minetto and three in Oswego.

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Lamp Renewals Not Mandatory

Maintaining that a public utility which furnishes free lamp renewal service is not required to supply clear lamps in place of frosted globes, the Pennsylvania Public Service Commission has dismissed a complaint against the Philadelphia Electric Company. The order stated that the company's "rates and the free lamp renewals service clause of its tariff were drawn to provide for the furnishing of lamps of standard manufacture and that inside frosted globes have come to be such commercial standard . . . There is nothing in this record that shows any practical or legal reason why respondent should be required to carry the costlier clear lamps in stock to satisfy preference of complainant . . ."

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Golden Anniversary in Los Angeles

On December 30, 1932, the Los Angeles Gas & Electric Corporation observed the 50th anniversary of Los Angeles' first electric service by the Los Angeles Electric Company, pioneer predecessor of the electric branch of its organization. The original service was confined to street lighting by direct-current arc lamps placed on seven masts, each 150 ft. high, located at various points about the then small city of some 12,000 population. The first electric plant had a generating capacity of 30 kw. and the electric load at that time was less than that needed to floodlight the stack of the company's Seal Beach station today.

Beryllium Now Available for High-Strength Alloys

After resisting for seventeen years the tireless efforts of metallurgists, beryllium, one of the less familiar metals, has at last yielded to successful commercial production at a cost which is not out of line with competing metals. The research work undertaken by the Beryllium Corporation of America and its successor, the Beryllium Development Corporation, and Siemens & Halske of Germany has resulted in the wider availability of this metal for use in its pure state or for alloying with other metals at lower prices than heretofore. The American Brass Company has recently announced a complete line of beryllium-copper alloys in sheets, strips, rods, wires and tubes and it is expected that other brass companies will make similar announcements soon. Forced capacity production is now under way at the Marysville, Mich., factory of the Beryllium Development Corporation.

Beryllium is lighter than magnesium, is but two-thirds as heavy as aluminum, but is almost as strong as steel. It is hard enough to cut glass easily, yet machinability of its alloys compares favorably with other high-strength materials. The electrical conductivity of beryllium, although less than copper, is much higher than that of other high-strength material and is increased by the same heat-treatment used to improve its physical properties.

Utility engineers are examining the new material as a possible high-strength conductor. They are also interested in it for pins and sockets for electrical appliances for household and factory, in which the abrasion resistance of beryllium alloys would reduce service charges and fire and shock hazards.

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Filamentless Radio Tubes Demonstrated for Wide Use

Another one of those simple little things that sometimes upset kingdoms, dynasties and industries, by eliminating the supposedly essential and wholly conventional elements upon which the established order is based, burst upon the technical world of radio the other night when Dr. August Hund, research engineer of Wired Radio, Inc., a subsidiary of the North American Company, demonstrated and discussed the characteristics of the filamentless radio tubes upon which he has been working experimentally at the company's laboratories for more than a year and a half.

Simplicity, low manufacturing cost, long life and satisfactory service are the advantages claimed for the filamentless tubes. The devices operate on direct current and require a single voltage. At the demonstration before the Institute of Radio Engineers in New York Dr. Hund operated a four-tube set and received programs from local broadcasting stations reproducing the music loud enough to be heard clearly throughout the hall.

The tubes have been the subject of intense and secret research in the laboratory of Wired Radio by Dr. Hund and associates. More than 900 different bulbs, none having filaments like ordinary vacuum radio tubes, have been made experimentally. These tubes accomplish all the operations normally required of a vacuum tube, in addition to many that are unusual. Some have operated on test continuously for more than 1,200 hours.

The bulbs are made in a wide variety of shapes and sizes. Inside each, when in operation, a purple glow is evident. Two or three small wires are projected inside each glass envelope, from terminals on the outside ending in a base like that of the ordinary radio tube.

An official of Wired Radio, when asked if the new tubes were likely to find their way on the market in sets very soon, admitted that "something is likely to happen within a year."

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London-Brighton Line Opened

Electrified service on the Southern Railway's London-Brighton main line was inaugurated December 30, when the first train, carrying the Lord Mayor of London, sheriffs and railway officials as passengers, reached Brighton in 52 minutes. As announced in the ELECTRICAL WORLD, November 12, page 648, plans to open service to the public were consummated January 1 with an all-day service of six electric trains an hour to and from Brighton and adjacent South Coast towns. The project cost approximately $9,100,000.

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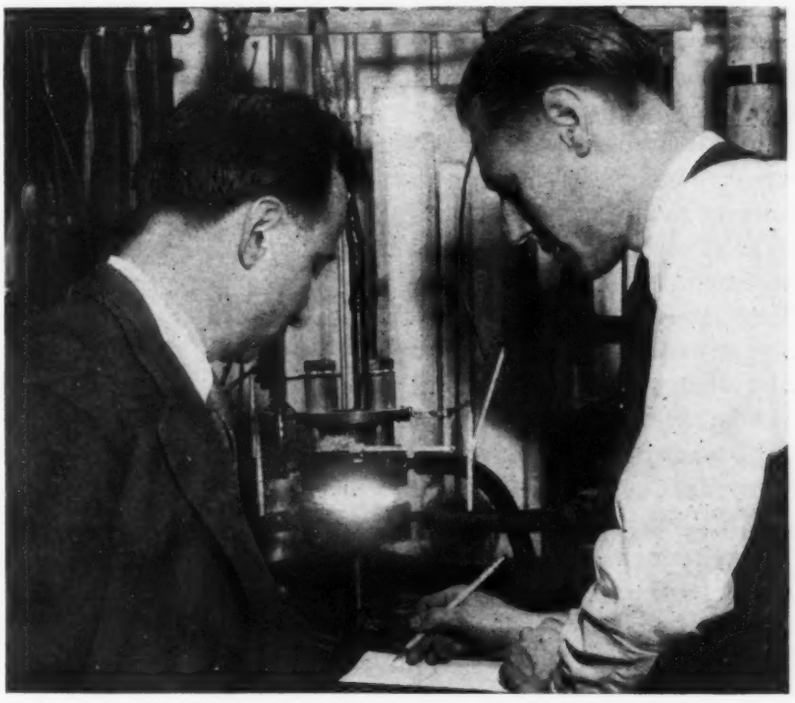
Mercury Rectifier Control Now Faster and More Positive



Development of a revolutionary method of controlling mercury-arc devices which is more positive and many times faster in action than methods now in use has been made by Joseph Slepian and Leon R. Ludwig of the Westinghouse research laboratories. The arc can be started 60 times a second at any point on the voltage wave, and since there is no grid to be protected from heating, but merely a carborundum-pencil dipping in the mercury pool, large currents can be controlled just as easily as small ones. The small laboratory specimen of the new "Ignitron" tube illustrated is carrying 60 amp. at 185 volts d.c. with only 0.15 average ampere and 30 watts loss in the control element of the rectifier.

The main feature of the Slepian-Ludwig control is a high-resistance rod, partly immersed in the mercury pool, which when energized starts an arc cathode. For a $\frac{1}{8}$-in. resistor rod dipping $\frac{1}{4}$ in. below the surface of the mercury tests showed the minimum voltage for starting the arc to be about 130; a sudden application of 250 volts started the arc in less than 5 microseconds. Details of this form of control will be discussed by Mr. Slepian at the forthcoming A.I.E.E. meeting in New York.

EDITORIALS

L.W.W.MORROW
Editor

Welcome to the Edison Electric Institute

THE organization of the Edison Electric Institute is a very logical movement in the electric light and power business. It makes it possible to have a single organization of utility companies to replace both the National Electric Light Association and the Association of Edison Illuminating Companies. It has a constitution that profits by past mistakes of the industry and makes it possible for leaders of the Institute to correct obvious evils that may arise in the industry. Very definite commitments are required of members and adherence to the basic principles and ethics of business conduct will be enforced and practiced. Its officers and original members consist of operating and holding company executives who are the leaders of the industry and control the majority of its active business enterprises.

With such a sound and definite purpose and with such leadership there is every reason to predict a welcome and a success for the new organization. It starts with a new and honorable name, it is unified in membership, it states objectives that are in the public interest and it looks to the future. Rightfully or wrongfully, the National Electric Light Association had gained a reputation as a propaganda organization, it had a diversified membership, it had no power to discipline or control its members and its organization had become cumbersome and unwieldy. It is to be hoped that both the N.E.L.A. and the A.E.I.C. will find in the new Institute an answer to the co-operative needs of the industry. It is the part of wisdom to unify the industry and to start anew with wholehearted support of the Edison Electric Institute.

For a new deal in trade relations, too

WITH a new year starting and a new administration in Washington, it would seem that there might be a new deal also between the power companies and the dealers and contractors. The attitude of the power companies has materially improved in that there is a general recognition now of the importance of trade relations in the development of the market and the bad effect on public sentiment that comes from hard feelings in the local electrical family. But, with a few notable exceptions, too little has been done in the way of active measures to establish a basis of actual working co-operation.

It has been recommended here that the time-honored New England town meeting plan might well be adopted. That is, a day might be set apart, say twice a year, when the dealers, contractors, wholesalers, manufacturers and the power company executives could sit down together in each community to review all issues and set up the program and the policies for the next six months by frank discussion and agreement. For the mere fact that a time and place was provided openly to consider these common problems and act on them would in itself bring a sense of security that would make for harmony and mutual confidence. The wonder is that it is not now being generally done.

Such a meeting, however, would not be the usual so-called "conference," or even a league meeting with a program of set speeches and all discussions of controversial issues carefully avoided. There is too much of that sort of thing, too many meetings where the men of the utility get the jitters because some contractor or dealer

publicity attacks its policies. And every time such an opportunity has been lost to explain and discuss the company's policies it has cost dearly.

Some day the electrical men in each city will be sitting down together at regular intervals to work out the rules for the family. If the power companies will take the lead in the right spirit this new deal can begin right now.

New miracles in science

IT IS a welcome relief from the theorists who paint a black picture of the effects of technological progress to find that scientists and engineers face the future with confidence. Progress comes from experimentation and scientific development and not from statistical analyses of the past. It is very encouraging, therefore, to study the addresses of the American Association for the Advancement of Science and to note the many new developments that have been made. It is even more encouraging to study the predictions of scientists such as Dr. Karl T. Compton.

High-voltage electrical experiments in 1933 promise to exceed by tenfold anything of the sort known in the past. Closely related will be experiments to find more about the atom, the electron, the cosmic ray and atomic energy. All this work promises new developments in practical applications of "electrostatic engineering," in the opinion of Dr. Compton. Physics will enter into chemistry and engineering in new ways and never was engineering less standardized in its practical application or in its textbook contents than it is today. It is possible and even probable that the scientific anarchists will demolish our present technological equipment and practices and replace them with better ones and, in addition, supply many new ones for human use. At no period in the past has there been more promise of an era of new scientific discovery and invention.

Removal of the debt burden, a readjustment of production and consumption to secure control and balance and the development of new equipments and services through technological advances—this is the program that will bring not only a return of prosperity but advanced standards of living for all.

More nuts to crack

NEVER has there been much doubt about the future of the kilowatt-hour. But now supreme confidence in its immutability leads to the proposal to build our currency system on it. Utilities would deposit with the Treasury "futures" in kilowatt-hours and in return get "electric dollars," according to the scheme advanced to the Econometric Society at the annual A.A.A.S. meeting by Dr. John Pease Norton. Tentatively he sets a dollar as 40 kilowatt-hours, which looks suspiciously like 2½ cents per kilowatt-hour, a figure which also happens to be half what a trolley ride was preordained to cost. He also states that the costs involved in producing a kilowatt-hour do not vary greatly.

Between this econometrist and the technocrats one finds little to choose. The technocrats are busy at the job of ferreting out the relationship between energy, production, employment and population to prove their assumptions. They hope to discover points of inversion on the curves of many fundamental industries that will force recourse to adoption of the energy unit, with no commodity value, as the measure of wealth. The econometrist fixes prices for all things from energy as a datum and gives his energy unit a commodity value. Both groups are so theoretical that the public understands neither.

Now it is risky to make light of our plight, but these proposals do resolve our plight into light in the last analysis. The fixedness of the watt and the second rest on the permanence of light wavelengths, the solar year and the stable density of water. These appear far more stable than the value of an ounce of gold, fluctuating as it does with the volume of extraction from mining activities. But the fallacy rests in attributing to the kilowatt-hour the high degree of scarcity which gold always has. The set-up proposed might easily lead to a great scramble to multiply kilowatt-hour output indefinitely and enhance the ills of technologic unemployment even though it did prove a temporary bonanza to the electrical industry. But where would relative values be then? One thing only is certain, and that is that the reformers would at last be able to proclaim that the luxurious 5-cent kilowatt-hour had become manna at half that price.

Balancing "Technocracy"

By L. W. W. MORROW
Editor ELECTRICAL WORLD

EVEN leaders in the scientific world state that man cannot avoid becoming the victim of his own creation, cannot solve the economic and social problems which the age of machinery has brought and cannot emerge from the depression in which civilization now wallows. This is the counsel of defeat; man deserves no better fate if he has not the imagination and ability to master his creations and environment. The counsel of victory is that man's historic aspirations for a better, freer and more abundant life are not doomed to frustration; they are destined to fulfillment.

Those who would win victory, however, must resolve the paradox of poverty and instability amidst the plenty that now exists. It is not enough to say that invention and technical skill are at a height that makes a comfortable and secure standard of life available to all the people of the nation. It is not enough to say that our mineral and agricultural resources are adequate and our technological progress sufficient to abolish scarcity and drudgery. It is not even enough to plan an engineering program of balanced economy. The affairs with which we have to deal must be visioned with a breadth and perspective that also considers the people—their traditions, their prejudices, their notions and their shifting social needs and economic interests. We must produce a plan whose composite contents make it fit the practical demands of our present democracy.

This can be done, but only by striving to reduce complexity to simplicity; by restricting action to limits possible of control; by retracing our steps in some measure and taking new roads; by writing off the mistakes of the past, even though they now appear as assets. We must start at the bottom with unemployment, supply and demand, local economic and social forces, and we must work in rather narrow geographical limits as unit groups in order to get action under simplified and consequently controllable conditions.

Existing economic conditions

We must start our action with facts instead of theory and then uplift the facts with controlled imagination. Some of the well-known facts now available as a guide may be stated:

1. There are more agricultural products available than can be consumed.
2. Technological progress is so great that machine production can equal consumption of manufactured goods without employing all workers for production in normal times in this country.
3. A great waste exists because of the so-called cost of distribution which is involved in the space factors, time factors and cost factors that exist between producing enterprises and consuming markets.
4. There is a certain size of production plant or farm that will produce at maximum economic efficiency, and this size is rather small both as regards production in one location or the production of a single product.
5. Capital accumulation has outstripped capital consumption, leaving an unbalance that apparently introduces the old economic principle that capital must be confiscated at intervals for the capitalistic system to survive.
6. More and more it becomes evident that true wealth is goods and services actually used or bought and sold at any time and is not measured by physical or fixed tangibles such as land or factories.
7. We still have unfulfilled human needs and desires that can be supplied by increased production if purchasing power can be supplied to consumers.
8. There is a widespread growth of artificial political barriers to handicap the free operation of economic forces in production and consumption.
9. The greatest handicap to recovery consists of commitments to pay in the future—national, state and private debts and mortgages and securities entitling their holders to participate in earnings upon investments made in the past that may have no earning capacity in the future.
10. An arbitrary and dictated economic or social program is undesirable as well as impossible in our democracy. It must be granted, however, that population growth is about stationary, investment in machine and agricultural productive power has outstripped the increase in consuming purchasing power and technological forces have rendered obsolete much of our present financial and business organization.

Specific applications of economic forces

These are general statements and perhaps it is advisable to cite some unrelated facts that support some of these conclusions:

1. A recent study in the machine tool industry shows that the economic size of a plant is one that uses 80,000 to 100,000 man-hours per year, yet this group represents only 3.5 per cent of the productive capacity of this industry. Studies of three other industries show the same facts; i.e., a relatively small production unit is most economical, but at present the greatest productive capacity is found in the larger plants.
2. Of all sections of this country, the most stable and with least unemployment has been New England. This area is most completely self-sustaining, with the greatest diversity and decentralization in manufacture and agriculture.
3. A certain manufacturer three years ago supplied the national market from three production plants and manufactured eight products. Today this manufacturer has 40 production plants, one in each market area, and sells 65 products through one sales staff. Present earnings are splendid.
4. Light and power growth was first premised on large generating plants concentrated in location, with widespread transmission systems over large areas—the larger the service area the more economical the operation. Today economy in all aspects of the business, as well as good service requirements, indicates that a rather restricted area is sufficient for one operating management. Also many relatively small generating stations and few transmission lines is the most economical system arrangement.
5. An analysis of the growth of manufacturers shows that small plants or branch plants are being built in each market area and, on the whole, these are more prosperous than the large plants supplying the national market because they restrict their activities to sales in these local areas. The manufacturers who make one product for the national market with a single production plant in one location are suffering the greatest losses.
6. Single-crop wheat and corn farmers find it impossible to survive, while many diversified farmers are fairly prosperous.
7. Shifts in conditions occur that make some markets saturated or even obsolete from time to time; for example, the era of high-voltage transmission caused several large high-tension insulator manufacturers to build large production factories. This transmission era has passed very largely for the next few years and any one of several of these plants should be able to supply the expected market for high-tension insulators during the next

ten years unless unexpected developments occur. Another example of industry shifts is found in the electric street railways.

8. There is a decided growth in the use of "reciprocity" in buying and selling and in sentiment for the encouragement of local production and local buying. Hand-to-mouth buying, immediate delivery, relief from transportation charges, warehousing and overhead organization costs resulting from a national business enterprise add additional economic advantages to the local sentiment values that are being capitalized by local producing farms and factories.

9. Leaders such as O. D. Young and Henry Ford have said that labor must be diversified even if a workman only worked about his house and garden for a certain period each week. The agitation for the short-hour week indicates this trend, but this idle time of labor, if obtained, can be capitalized for the benefit of labor and of the country through use of the diversity of labor principle. There need be no unemployment, however great the technological advances.

10. Under best conditions our export business has been about 10 per cent of our total national business volume, while imports were equivalent to about 7 per cent. With depreciated currencies, an absence of new American loans to foreign interests and increased world competition from low wage areas, there is no doubt that (a) this country is practically self-sustaining; (b) export business, in certain products at least, must decrease unless we meet the international competition, on a comparable money and wage scale. Just now there is a very positive increase of imports into this country because of the relative advantages we offer to foreign competition.

Plan of decentralization and diversification

These principles and facts may be used to develop a plan that offers the control and balance necessary to remedy the maladjustments and dislocations that exist in our national affairs in some degree. This plan merely takes advantage of the economic forces now at work and is limited to the extent that it deals with business; i.e., supply, demand, capital and labor. The general principle of such a plan may be stated broadly as:

1. Since we are so nearly self-sustaining let us work out our internal adjustments first and make ourselves more self-sustaining.

2. Within our borders let us, in principle, divide this country into logical economic areas and try to make each area self-sustaining as to production and consumption.

3. With decentralization and with the development of sulf-sustaining areas there is a necessity to diversify agriculture, manufacture and labor.

Farms and factories must be smaller and diversified in order to produce all the goods required by the area and labor must be diversified in order to produce the diversified products and in order to increase the purchasing power of workers.

4. Within each logical economic or trading area controls must be established whereby both supply and demand are kept balanced and whereby a continually increased purchasing power will be had so as to sustain a continually increasing production.

5. Export and import business between economic areas and between this country and other countries would occur only where local advantages in one area make such a procedure advisable.

There is no reason for a 1,000,000-acre farm in Kansas, for example, to raise wheat to supply Great Britain when both land and labor exist in that country for producing it at about the same cost—far lower if transportation, warehousing and middlemen charges are considered. But some of our cotton, tobacco, oil and certain other products may be exported under controlled conditions and we may import nitrate, or other products, from other countries. But the export and import business between economic areas within our borders and internationally would be based upon total costs from producer to ultimate consumer or upon special local advantages in resources and this business would be controlled within definite economic limits. Exports and imports would not be based upon the "dumping" principle. The analogy is fair that import and export business would be the high-voltage transmission lines between local generating stations to take advantage of diversity and the most economical local production.

Practical applications under way

The practical aspect of this discussion is that these suggestions are being applied. Manufacturers are building branch plants in the several market areas. Agriculture is being forced to diversify. Labor finds it cannot specialize on one kind of work at full time. In the South it is discovered that canned goods, clothing, dairy products and other manufactured products needed in the area bring prosperity and that more textile plants, more cotton and more tobacco are inadvisable and uneconomical. In New England the process of readjustment has already gone far because of the past movement of metal working, food products and textile plants to other market areas. With very little added effort New England could be made self-sustaining and could also develop its exports and imports on an economic basis. The Pacific Coast and the Southwest are notable examples of current developments in decentralization and diversification in both manufacture and agriculture. In the Middle West also these principles are being carried to fruition through the working of economic forces. Only in the corn, wheat and cattle belts is there found too great a specialization and concentration upon single crop production and in these regions, despite all the governmental aids, economic forces will either bring bankruptcy or the application of decentralization and diversification.

So far as production is concerned, therefore, to a limited extent we are already doing the things needed to bring some order and balance into being. The most difficult adjustment, however, is more labor diversification. Employment in future must be dependent more largely on the diversification of labor if unemployment is to be avoided and if the purchasing power of labor is to increase. As rather extreme examples, for instance, a man may work in a factory four days and in his garden one day; a machinist may work on a lathe in an automobile plant one day, in an airplane plant on another day and in a repair shop a third day. A common laborer may farm part of the time, be a plumber's helper part of the time and help on construction projects at other times. There is no doubt but that employment could be had for all under normal conditions once labor adjusted itself to the diversification demands necessary to a balance, but the readjustment will be difficult since all this must be done in each locality very largely and human attitudes must be changed.

In any discussion of employment it should be noted

that the advent of women as workers, the growth in clerical workers, in the professional branches and in employees for governmental purposes has created an enormous group of people between production and consumption that must be supported. It is this group that will be largely affected by plans for better economic efficiency, and the effect of technological progress is minor in comparison to the effect that economic forces will have on this, in a sense, non-productive labor.

There is no doubt also that in addition to a balance in production and in labor employment obtained by decentralization and diversification there will be needed marked changes in the conduct of other aspects of business. A balance between money accumulation and money expenditure must be had whereby purchasing power increases at the same rate as production facilities. Capital turn-over must be the business goal instead of capital accumulation. There must be relief from the present burden of promises to pay and a restriction on future promises to pay. But these can be developed only after the basic economic balance in production, consumption and employment has been obtained. And until these foundations are built the present attempts to repair the top structure will be ineffective. The place to start and, fortunately, the easiest place to start is at the bottom.

Before closing it is well to point out that these suggestions are far from complete and inclusive. They do embody, however, an attempted interpretation of present economic forces and suggest how to go along with these forces instead of combating them. They suggest an approach that is believed to be tangible and practicable and only by undertaking to apply these principles is there hope for a permanent readjustment of our civilization. These changes are now occurring and it is wise to capitalize upon them instead of drifting into the chaos from which we shall emerge eventually.

Granted that the resistance level of the depression has been reached and that we cannot rise from this level until the debt burden is readjusted to present price levels through agreements, inflation or bankruptcy, it is the part of wisdom to measure the economic forces that create maladjustments in labor, production and consumption and to attempt to apply the principles outlined to create stability.

▼

Soldering Lugs Are Standardized

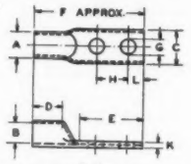
By HENRY C. ANDERSON*

Chairman N.E.L.A.-N.E.M.A. Joint Committee on Specifications for Terminal Lugs

Standardization of soldering lugs was recently accomplished when the report of the N.E.L.A.-N.E.M.A. joint committee on specifications for terminal lugs was finally accepted by the three interested N.E.L.A. committees, namely, electrical apparatus committee, overhead systems committee, underground systems committee and by the codes and standards committee of N.E.M.A. after five years' effort toward standardization. The standard duty types shown in Table I present a terminal lug with ample thermal capacity for normal duty. Where an increased thermal capacity is desired for withstanding heavy overloads or short circuits the heavy-duty lugs described in Tables II and III should be used, depending upon the individual's choice of pressed or cast lugs. The design of both types of lugs was predicated on tests and operating experience secured by both manufacturers and electric utilities. It should be noted that the diameters and the spacings of the bolt holes are the same for all sizes from 250,000 to 2,000,000-circ.mil standard and heavy-duty types.

New York & Queens Electric Light & Power Company, Flushing, N. Y.

Dimensions of multiple-bolt copper soldering lugs



I—Standard-duty pressed lugs

MAXIMUM CABLE	DIMENSIONS IN INCHES									
	A	B	C	D	E	F	G	H	K	L
No 2 A.W.G.	.437	.336	5/8	1/2	1 1/2	2 1/2	5/16	1	.102	11/32
No 2/0 A.W.G.	.562	.461	1 3/32	1 3/32	2	3 1/8	7/16	1	.102	3/8
250 000 C.M.	.812	.684	1 13/64	1	3	4 1/2	3/16	1 1/4	.143	3/8
350 000 C.M.	1.000	.822	1 1/4	1 1/4	3	4 7/8	7/16	1 3/4	.178	3/8
500 000 C.M.	1.062	.881	1 21/64	1 1/4	3 1/2	5 1/2	7/16	1 3/4	.181	3/8
* 750 000 C.M.	1.312	1.084	1 1/2	1 1/2	3 1/2	6	7/16	1 3/4	.229	3/8
* 1000 000 C.M.	1.437	1.209	2 3/64	2 1/16	3 1/2	6 3/8	7/16	1 3/4	.229	3/8

* SUITABLE FOR ROPE CORE CABLE WHEN CORE IS REMOVED AND DIAMETER OF CONDUCTOR IS REDUCED.

ALL DIMENSIONS ARE SUBJECT TO ORDINARY MANUFACTURING TOLERANCES.

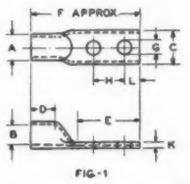


FIG.-1

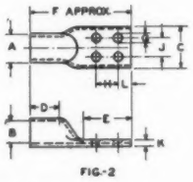


FIG.-2

II—Heavy-duty pressed lugs

MAXIMUM CABLE	FIG.	DIMENSIONS IN INCHES										
		X	B	C	D	E	F	G	H	J	K	L
250 000 C.M.	1	.840	.625	1 1/4	1 1/4	3	5	5/16	1 1/2	—	.220	3/8
350 000 C.M.	1	1.050	.822	1 1/2	1 11/16	3	5 1/2	7/16	1 3/4	—	.230	3/8
500 000 C.M.	1	1.315	.951	1 1/2	2	3 1/2	6 3/8	7/16	1 3/4	—	.370	3/8
* 750 000 C.M.	1	1.660	1.272	1 3/4	2 3/16	3 1/2	7 1/8	7/16	1 3/4	—	.390	3/8
* 1000 000 C.M.	1	1.900	1.490	2 1/8	3	3 1/2	7 7/8	7/16	1 3/4	—	.410	3/8
* 1 500 000 C.M.	2	2.370	1.930	3	3 7/8	4 1/4	9 3/8	9/16	1 3/4	1 3/4	.440	3/8
* 2 000 000 C.M.	2	2.870	2.315	3 1/2	4 3/8	4 1/4	10 1/2	9/16	1 3/4	1 3/4	.580	3/8

* SUITABLE FOR ROPE CORE OR ANNULAR CONDUCTOR CABLE.

ALL DIMENSIONS ARE SUBJECT TO ORDINARY MANUFACTURING TOLERANCES.

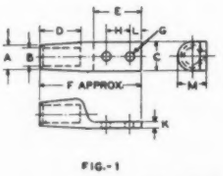


FIG.-1

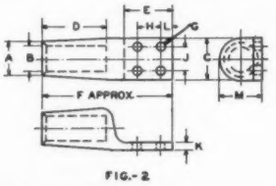


FIG.-2

III—Heavy-duty cast lugs

MAXIMUM CABLE	FIG.	DIMENSIONS IN INCHES											
		A	B	C	D	E	F	G	H	J	K	L	M
250 000 C.M.	1	7/8	.625	1 1/2	1 7/16	3	5	5/16	1 1/2	—	.375	3/8	1
350 000 C.M.	1	1 1/16	.750	1 1/2	1 11/16	3	5 7/8	7/16	1 3/4	—	.500	3/8	1 1/2
500 000 C.M.	1	1 5/16	.875	1 1/2	2 1/16	3	5 7/8	7/16	1 3/4	—	.500	3/8	1 1/2
* 750 000 C.M.	1	1 5/8	1.250	1 3/4	2 5/16	3	6 5/8	9/16	1 3/4	—	.500	3/8	1 7/8
* 1000 000 C.M.	1	2	1.500	2 1/4	3 3/16	3	7 1/2	9/16	1 3/4	—	.500	3/8	2 1/4
* 1 500 000 C.M.	2	2 7/16	1.937	3	4 1/16	3	9	9/16	1 3/4	1 3/4	.825	3/8	3
* 2 000 000 C.M.	2	2 13/16	2.312	3 1/2	5 3/16	3 1/2	10 1/2	9/16	1 3/4	1 3/4	.825	3/8	3 1/2

* SUITABLE FOR ROPE CORE OR ANNULAR CONDUCTOR CABLE

ALL DIMENSIONS ARE SUBJECT TO ORDINARY MANUFACTURING TOLERANCES.

Simple Scheme for Customer-Service-Continuity Records

By WILLIAM R. HAMILTON
Superintendent of System Operation
West Penn Power Company

TWO general methods of tabulating service records are in general use by power companies. One method is to tabulate the service by a record of the load interrupted, tabulating the data in kva.-minutes load lost. This method is the more complicated of the two to set up and maintain. An organization would have to perform more work to tabulate and to keep its records up to date under this plan. Its use also brings up the debatable question as to how the kva. interrupted shall be determined; i.e., transformer installation, billing demand, average load, etc.

The second plan is to record the interruptions, the customers or units of service interrupted and the number of minutes of service interrupted, or some modification of these three items. Records worked up under this plan show that it is easy to maintain and, also, the information presents an accurate story of the service, but it has the possible objection that all interruptions are given equal weight regardless of the amount or type of load interrupted.

One modification of the second plan is to record:

1. The number of interruptions that occur.
2. The number of service units interrupted on each interruption.
3. The number of interruption minutes which for each interruption is the length of the interruption times the number of service units interrupted.

One recommended definition for a service unit is:

1. Each transformer station of 11 kv. or more primary voltage which serves one or more customers. (Certain small distribution transformers served at these higher voltages are exempted from this group and the lines serving them grouped in the group listed below.)
2. Each distribution line of less than 11 kv. which is controlled by a breaker from any power company substation serving more than one feeder line so controlled.

There has to be some point in the system beyond which it is not reasonable to include such detailed data. Generally, operating departments, particularly the system operating departments, have little concern about the operation of distribution lines after they leave the substations and of individual customers who are served from the distribution lines. Basically, the extent of records to be kept are the records of service to customers or lines which are directly under the control of the system operating organizations. Generally, data about higher voltage customers or higher voltage stations are kept as stations, but data about the distribution systems are kept as individual lines.

No lines of more than 12 or 13 kv. as lines and no substation buses or automatic stations as a whole should be tabulated as service units. Lines of less than 11 kv. which are not controlled from an automatic station by a breaker should not be included as service units, as such service generally is not under the control of the operating organization. The 11-, 12-, or 13-kv. lines which are considered as distribution lines are counted as service units. Such lines, if considered as transmission lines, are not so counted. In the latter case each station served from the line or the feeders served from these stations is counted as a service unit. This distinction is made principally between load served in metropolitan and rural areas. Branch lines tapping from main distribution lines should not be included, as generally this service is handled locally.

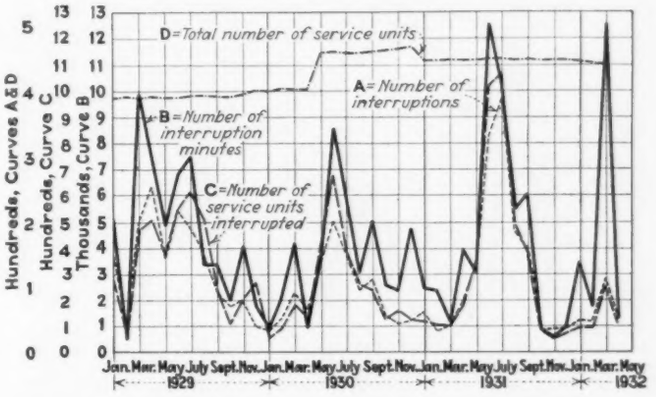

D=Total number of service units
A=Number of interruptions
B=Number of interruption minutes
C=Number of service units interrupted
Hundreds, Curves A&D
Hundreds, Curve C
Thousands, Curve B
Jan. Mar. May July Sept. Nov. Jan. Mar. May July Sept. Nov. Jan. Mar. May July Sept. Nov. Jan. Mar. May
1929
1930
1931
1932

Fig. 1—Customer-service-continuity record by months

A typical interruption record by months showing the seasonal trend. It will be seen that the curve for the number of interruptions, the number of service units interrupted and the number of interruption minutes follow very closely each other for any given period. This is evidence that the average accuracy of this plan is high. The peaks during the spring and summer months are due to sleet storms and lightning storms. The record by months shows the service record by seasons, but the record should be in larger units (Fig. 2) to show a definite trend.

Interruptions which are prearranged should be grouped separately. Generally such interruptions are taken at a customer's convenience, even when taken to remove hazards from the system, otherwise the interruption would not be prearranged. The increasing use of hot-line tools which permit work to be performed without de-energized lines instead of requiring interruptions to perform the work is shown in a record of prearranged interruptions.

Following are listed a few interpretations of certain conditions experienced frequently:

Recording Line Interruptions—When an interruption occurs to a line and power is restored to all customers or service units the report of the interruption is entered on only a master card for the line. When power is not restored to one customer the master card will name the customer not picked up. The interruption for this customer will then be noted on its own card also.

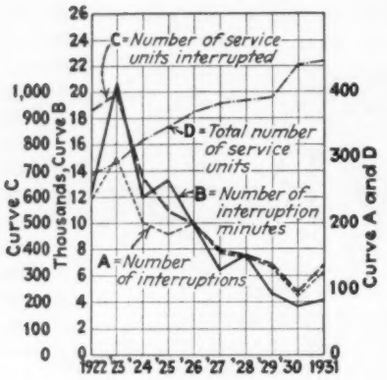
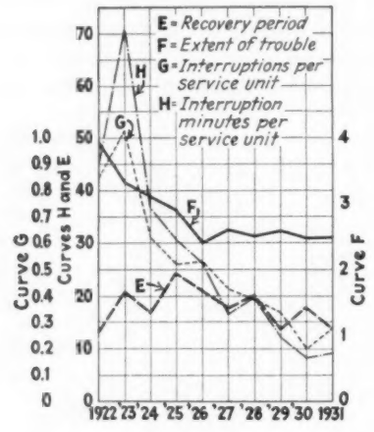

C = Number of service units interrupted
D = Total number of service units
B = Number of interruption minutes
A = Number of interruptions
Curve C
Thousands, Curve B
Curve A and D
1922 '23 '24 '25 '26 '27 '28 '29 '30 1931

Fig. 2—Typical ten-year interruption record

A very definite improvement has been accomplished during this period. Curve D shows that the power system has grown during the period, but even so the number of interruptions (curve A), the number of interruption minutes (curve B) and the number of service units interrupted (curve D) are on a definitely decreasing trend.

Fig. 3—Unit interruption values improved


E = Recovery period
F = Extent of trouble
G = Interruptions per service unit
H = Interruption minutes per service unit
Curve G
Curves H and E
Curve F
1922 '23 '24 '25 '26 '27 '28 '29 '30 1931

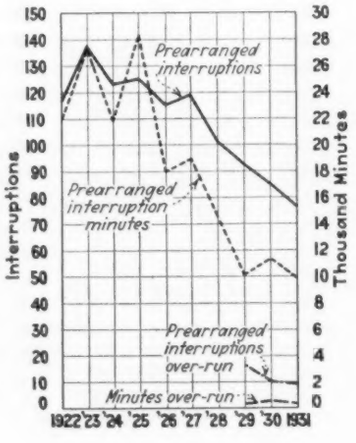
Curve H shows the number of interruptions per service unit over a nine-year period. This is obtained by dividing curve A in Fig. 2 by curve D. The decreasing slope of this curve emphasizes the improving service to each customer better than just the number of interruptions, which does not consider system expansion.

Curve E is the recovery period of each interruption. This is obtained by dividing curve B by curve H. This curve does not show much improvement, which has been due partly to the fact that the unit of time used was not sufficiently small. This curve should show any benefits obtained by autimatic reclosing equipment and quicker sectionalizing of lines during trouble because of better transportation facilities and more improved roads. Interruptions should be recorded in units of one-half minute instead of one minute in order to bring ont any gain in service restoration time obtained by the installation of automatic reclosing breakers and the faster closing of breakers manually.

Curve F shows the extent of trouble resulting from each interruption. This is obtained by dividing the number of service units interrupted (curve C) by the number of interruptions (curve A). The decreasing slope of this curve shows the improvement brought about by better relay equipment and the installation of additional breakers and automatic air switches to make possible sectionalizing of lines into smaller units.

Fig. 4—Prearranged interruptions by years

This chart shows a definite decrease in the number of interruptions and the number of minutes interrupted arranged for and taken on customers, even though the system has grown as shown on curve D, in Fig. 2. This reduction emphasizes the benefits obtained from establishing two or more sources of power and more and better sectionalizing facilities of transmission and distribution lines. The three-year record of arranged interruptions over-run brings out the effort taken to perform work within the time scheduled. The record makes possible special analyses of nearly any special study of interruptions desired.



When the interruption to more than one customer differs from the time service was restored to part of the line the master cards show the time the line was interrupted with the note "See individual card."

Single Phase—A single-phase condition on three-phase service is classed as an interruption.

Delayed Reports—If the power company is not notified of an interruption to a customer served from a station protected by fuses within an hour after the interruption started the interruption is considered as from the time the power company is notified. The full time is to be recorded on the interruption card under "Remarks," but only the time from the time of notice is recorded on the interruption record. If the company receives notice of the interruption within an hour after it occurred the time is counted from the time the fuse blew to the time when service was restored.

Customer's Trouble—A long interruption on a customer due to customer's apparatus failure is charged to customer's apparatus until the power company line is again energized to the customer. From then on any interruption is due to the customer's request. (VII-C page 65).

Temporary Disconnections—When a customer has his service disconnected for a week or two weeks the record should show this as a temporary disconnection and the number of service units are corrected to correspond, rather than have the interruption carried in the records from day to day until service to the customer is restored.

Second Interruptions—When an interruption has occurred and service has been restored any later interruption accompanying the same case of trouble shall not be charged to the cause of the first interruption unless the trouble is repeated. If three stations have to be dropped because of special conditions after a case of trouble the second interruption to the three stations will not be charged to the cause of the trouble, but to the special conditions. The second interruption classification indicates that changes are needed to improve service, otherwise the second interruption would not have been taken.

Double Classification—When one interruption is given two classifications, the interruption count, the number of service units interrupted and the number of interruption minutes charged to the first cause should be charged to the first classification. The number of interruption minutes is the only thing to be charged to the second classification.

Prearranged Interruptions Over-Run—Where there is an arranged interruption and the interruption is over-run the over-run interruption is listed on the card as a separate interruption and classed under VII-D. The persons who analyze the interruption cards know how to interpret this classification, and interruptions under VII-D are known never to be separate interruptions.

Severe Surge—A severe surge on the system which causes any industrial customers to lose their load by the tripping of any synchronous equipment or the operation of any low-voltage relays is charged as one interruption against the customer with zero time, the power never having actually been off. Such outages are often listed in customers' complaints when they are received, so a record of these momentary interruptions should be kept.

Length of Interruptions—An interruption of less than fifteen seconds' duration is reported as zero time. An interruption of from fifteen seconds to 45 seconds' duration is reported as one-half minute and an interruption of more than 45 seconds is given the time of the nearest half minute.

A system of classifying interruptions which makes available a valuable analysis of interruptions is to set up a classification so that each interruption is grouped according to its cause. The first four major divisions of the classification shown in the panel cover those interruptions charged to failures and these are subdivided into four parts, titled: major transmission, minor transmission, distribution, and miscellaneous. Each of these subdivisions is subdivided further to distinguish interruptions chargeable against station equipment, lines, foreign interference, etc. As this plan classifies each interruption according to its cause, distribution services may have interruptions charged to major transmission failures and high-voltage services may have interruptions charged to distribution failures.

Interruption Report Classification

I. Major Transmission (Above 50 Kv.)

A. *Substation Equipment:* Oil breakers, disconnects, arresters, transformers, instrument transformers, bus, air switches.

B. *Line:* Conductors, insulators, towers, poles, arms, pins, guy sets.

C. *Foreign Interference:* Falling trees, auto accidents, fires, material thrown or blown into line or bus.

D. *Auxiliary Conductors:* Telephone and ground wire.

II. Minor Transmission (15 Kv. to 50 Kv.) Inclusive

A. *Substation Equipment:* Oil breakers, disconnects, arresters, transformers, fuses, instrument transformers, all automatic air switches, bus, substation air switches, etc.

B. *Line:* Conductors, insulators, towers, poles, arms, pins, guys, non-automatic line air switches, line disconnects.

C. *Foreign Interference:* See IC.

III. Distribution (Below 15 Kv.)

A. *Substation Equipment:* See II-A.

B. *Line:* See II-B.

C. *Foreign Interference:* See IC.

D. Distribution transformers, fuses, line, arresters and metering equipment.

IV. Miscellaneous

A. Generating equipment.

B. Customer's equipment.

C. *Protective Equipment:* Relays, batteries, switchboard equipment, control signals, etc.

D. Telephone conductors and equipment 25 kv. or below.

V. Equipment

A. Switching on air-break switches or disconnects.

B. Load transfers due to inability to parallel.

VI. Operating Errors

A. Company employees.

B. Customer's employees.

VII. Prearranged Interruptions

A. Operating convenience, routine maintenance and construction.

B. Hazardous conditions, equipment and line failures.

C. Customer's request.

D. A or B over-run.

VIII. Miscellaneous

A. Lightning discharges without apparatus failure.

B. Faulty construction, or engineering: Slack lines, lack of proper equipment, incorrect wiring or connections.

C. Emergency switching due to fires or accidents.

D. Trouble on interconnected systems or on systems carrying part of West Penn load.

E. Cause unknown.

F. Power transformer fuses blown—no other trouble found.

The second general group of interruptions in the classification covers those interruptions which are charged against operation. The first main division under this group (V-A and V-B) cover general switching set-ups. Such interruptions are rather few in number. The second main division (VI-A and VI-B) cover operating errors. The records of these two divisions improve as operating practices improve.

The seventh main division includes all prearranged interruptions. These are not included in the curves of Figs. 1 and 2. Fig. 4 shows the nine-year record of this group and a two-year record of those prearranged interruptions which were overrun.

Prearranged interruptions also subclassified

The prearranged interruption classification is subdivided into four groups. The first group (VII-A) are those prearranged interruptions taken at a time of operating convenience or with the full approval of the customer at the power company's request for routine maintenance or construction purposes. The second group (VII-B) are those interruptions taken to remove hazardous conditions or to repair trouble. Often interruption complaints from customers have included prearranged interruptions, which, although prearranged, had been forced upon the customer to permit removing some hazardous condition from the system. The VII-B group is this group. The VII-C group covers interruptions asked by the customer. Occasionally the power company takes advantage of such interruptions to perform some work, but the interruption is still classed under VII-C.

The VII-D group includes all prearranged interruptions which have been over-run. Only the over-run time is recorded. The power company takes the attitude that an arranged interruption which is over-run is no longer an arranged interruption. Over-running interruptions hurt customer good will. This record has improved considerably since this record has been kept.

The eighth main division group includes interruptions charged to miscellaneous causes, such as lightning discharges without apparatus failures (VIII-A), faulty construction or engineering (VIII-B), emergency switching due to fires or accident (VIII-C), interruptions from interconnections (VIII-D), causes unknown (VIII-E), etc. Any interruption which cannot be charged in any other group is covered in this group. Care must be taken that the number of interruptions charged against (VIII-E) be kept to a minimum.

The shift load dispatchers can prepare, tabulate and complete the information covering customer service records prepared by operating departments. This record would be kept for and referred to by all interested departments. A shaft load dispatcher can assign the classification code to each interruption, note this classification on the load dispatcher's daily interruption log sheet and copy each interruption off onto the proper interruption card.

A card should be prepared at the first of the year for each customer, station or feeder assigned a service unit and at the end of the year all the cards are forwarded to headquarters. By having a card for each service unit, a blank card means this particular service unit had no interruptions during the year, and the question will not arise as to whether any card has been lost or mislaid, or whether actually no interruptions occurred to this particular service unit.

A master card printed with red ink can be made out for a line or station when several service units are controlled by the line or by one station. Then a note would be made on the master card when an interruption

occurs to this line or station, which, of course, interrupts all service units controlled by it. Considerable work is eliminated by its not having to be necessary to copy this interruption separately on the card for each service unit. Under this plan a complete report of interruptions to any service unit requires examination of the particular card for the service unit and possibly one master card. In general, interruptions caused by trouble on a particular service unit, equipment or locality will be only on that particular card. Interruptions to the source of power will be on the master card.

Each load-dispatching territory should make a monthly report of the number of interruptions, number of minutes of interruption and the number of service units interrupted, subdividing this report, according to the classification system, to a central point where the reports would be combined and the totals compiled to give the monthly report for the entire system.

Another classification of interruptions which is valuable is to group the service units according to the manner the service is rendered and then compare the quality of service obtained from each method. Records worked up from such a grouping will show the gain in service continuity obtained from more expensively designed stations and multiple sources of power.

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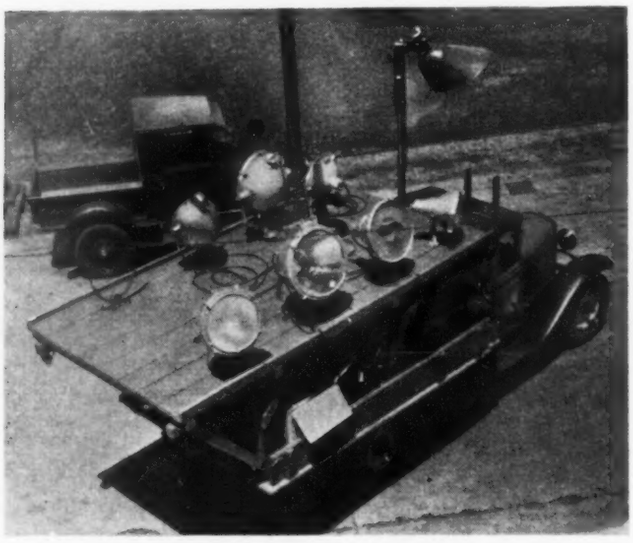
Sells Floodlighting by Demonstration

Equipped with floodlighting units loaned by manufacturers the truck here illustrated is used by the Central Illinois Light Company, Peoria, to show prospective customers exactly what their places of business will look like when properly illuminated. Lenses of different types and colors are provided to show various tone effects. Spike units for setting in the ground are run out from the truck. Prospects are secured by direct mail advertising, through salesmen of the utility and from electrical contractors. In two months of use the truck was directly responsible for the sale of eleven floodlighting jobs, of which seven were obtained through the interest and co-operation of electrical contractors. Actual load added was 52 kw., from which annual revenue of $2,600 is estimated. As a result of the truck demonstrations 39 more floodlighting jobs, totaling 125 kw., are practically ready for contracts as soon as business picks up.



All kinds of floodlights on demonstration truck

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Performance of Mine Hoists

Large variations in costs per 1,000 ton-feet for hoisting operations in Michigan copper and iron mines with electric power at the low end of the comparison and steam at the high are shown in the accompanying table, reproduced from the bulletin of the Michigan College of Mines and Technology, entitled "An Analysis of Electrical Equipment Used in the Copper and Iron Mines of Michigan." In explanation of the table the bulletin states:

The table shows the consumption of the various hoists of the different mines, based both on 1,000 ton-feet output and on the cost of energy per 1,000 ton-feet. The two last columns do not reflect on hoist efficiency, although they do reveal the conditions and facilities at the properties. There are several other items which should be taken into consideration when comparisons are being made—the depth, the speed of hoisting and, thus, the ratio of acceleration to the total period of the cycle; the shape of the drum, cylindro-conical, having a smoothing effect on the cycle load curve, and whether the drum is a single cylinder or a clutched double. The last point needs special attention.

All a.c. hoists visited and some small d.c. have single cylinders with rope lengths, corresponding to the lowest level. For instance, if twelve be the lowest lead, then when skip A is dumped, skip B is at the twelfth level; if most of the ore is coming from a different level, say the tenth, the number of times the hoist has to be started and stopped will be doubled, for, after skip A is dumped, skip B has to be brought from the twelfth level to the tenth to be filled (instead of being filled while A is being dumped). This movement of skips greatly increases consumption per 1,000 ton-feet and makes direct comparisons of different types on the consumption basis hardly possible, though a fair idea can still be obtained. The clutched double-cylinder hoist permits very easy and rapid adjustment of the two skips relative to each other, so that both are active at all times regardless of the level being worked.

The capacity of the hoist, as well as the capacity of the skip, is of importance too, as larger equipment would naturally be expected to be better and more efficient in every way; of two hoists of the same capacity, the one with heavier pull (skip) and longer cycle would be expected to have slightly higher efficiency, since the energy required to accelerate a heavier load to a lower speed is less and thus lessens the severity of the starting duty.

Comparison of Performances of Various Mine Hoists

Type of Hoist	Lb. Coal per 1,000 Ton-Feet and B.t.u. per Lb.	P.P. Equivalent†	Kw.-Hr. per 1,000 Ton-Feet	Cost per 1,000 Ton-Feet in Cents‡	Kw.-Hr. or Lb. of Coal per Ton
A. Ward Leonard*	.....	...	1.3	1.7	3.1
B. Ilgner*	.....	...	1.7	2.2	2.6
C. Ilgner	.....	...	2.2	1.1	2.3§
D. induction	.....	...	2.4	1.2	2.8§
E. induction	.....	...	2.7	.7	2.2§
F. induction	.....	...	2.8	.7	4.6§
G. induction	.....	...	2.9	1.5	2.0§
H. steam	8.8 12,000	3.1	...	4.4	22
I. steam	9.3 13,000	3.5	...	4.7	35
J. steam	9.9 13,000	3.8	...	5.0	20
K. steam	21	...	...	...	30

*Double-drum, clutched hoist.
†Kilowatt-hours that would be generated on the same fuel by a power plant with a thermal efficiency of 10 per cent.
‡Cost of H, I, J is based on coal price of $4 per ton.
§Private hydro-electric plant.

Approach to an Untouched Market

By DEAN W. TAYLOR*
Utility Management Corporation, New York

Includes process-steam users and exceeds present industrial power purchases.

Several ways in which customer objections can be overcome.

LESS than half of the combined mechanical and electrical energy used in this country is supplied by the electric utilities and probably less than 5 per cent of the heat energy used in commerce and industry is supplied by public utilities. This vast unsold market is still unsold after more than 50 years of central-station expansion and aggressive sales activity of many leading power companies. In your own territory you may be surprised to find that the percentage of power and heat supplied by the central station is even less than it was ten years ago. You may find that whereas your company's power load has increased each year at a fair rate, the growth of power and heating loads in industry has increased at a higher rate and that a substantial part of this load is being carried by private plants or by direct application of oil, coal or other form of energy in competition with central station services.

Consider only two industries in which central-station service has made comparatively little headway—rayon manufacture and textile finishing. Other less extreme examples are paper and pulp mills and chemical works. The reasons given by these concerns for making their own power are generally "greater reliability and lower cost." These industries claim that "the development and application of high-pressure boilers and extraction turbines to process steam loads permit large scale, economical generation of power. High-pressure boiler and turbine equipment can be purchased today for no more than low-pressure equipment cost a few years ago." They also contend that "the cost of energy produced by extraction turbines operating on high throttle pressure and low exhaust pressures may be as low as one-third the cost of the same energy produced in the average modern central station. The first cost of such an installation, when added to a large boiler plant, may be even less than the first cost of a modern central station. Furthermore, recent developments and improvements in equipment," it is claimed, "make possible these low costs of power for even the comparatively small industrial plant using large amounts of process steam; small loads that are generally not served at the low rates expected for a paper mill or large chemical works."

Whether these would be only transient advantages that would be offset by later disadvantages is an entire topic for discussion in itself. But meanwhile here is competition that may be as hard to meet in the small loads as in the larger blocks, particularly if power rates are to continue to be based on relative size and load factor (cost-to-serve theory) and not on the value of the service to the customer as measured by his own costs. To meet this competition requires courage, imagination, ingenuity, good service and a willingness and ability to meet the customer on his own ground.

If the central station is to maintain even its present fifty-fifty hold on the power business of industry it will have to make greater inroads upon this type of load. If it does not gain ground against this process-steam load, with its so-called by-product power, it will lose ground.

If we face the facts we must admit that unless we can develop a central-station policy that will permit the immediate sale of power and probably steam to the larger of these industrial concerns which have heretofore successfully resisted our efforts we will never sell them. Moreover, we may even expect to lose a substantial amount of our existing power load among those industries which can establish an attractive heat balance when utilizing modern high-pressure equipment.

A policy that will meet this situation will have to be quite different from that which has existed in many power companies heretofore where rates were too often based on the cost of service and the theory that the central station was a natural monopoly and should, therefore, make each class of business yield the same percentage of profit. Such a policy was generally accompanied by sales efforts centered around rates having little flexibility of application. An important factor that was overlooked was that large power customers are little interested in whether power rates must be fixed to yield the same percentage of profit on all classes of business. Large power users are generally more interested in whether your rates will permit them to buy power at a lower operating cost and with a saving in capital charges, compared with total costs of private generation.

Power salesmen are sometimes judged on their ability to sell power at the existing rate and are complimented on turning down business that could not be squeezed into the existing rate tariffs without determining whether other more favorable but equitable tariffs might be

Subjects Covered in This Series

Retaining Existing Customers.[1]
Sifting Power Prospects.[2]
Payment-Out-of-Savings Engine Contracts.[3]
Where to Begin Sales Approach.[4]
Process Steam — an Opportunity.
When the Odds Are Against You.
Meeting Diesel Competition.
Making Power Reports Effective.
Yardsticks for Power Sales.
Power Sales Management.

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[1]Published Oct. 22, 1932. [2]Nov. 19, 1932. [3]Dec. 10, 1932, [4]Dec. 24, 1932.

worked out. Such an attitude seems to ignore the implied obligation of an industry which is allowed to serve without competition so far as public franchises are concerned. This obligation may be stated in a number of ways, but Thomas A. Edison expressed it quite simply: "The duty of the public utility is to supply the best possible service to the largest number of customers at the lowest possible rates." This, it would seem, should be the real objective of a power company and it calls for efforts to be made to serve every existing power and heating load that is within the physical and economic reach of its facilities.

No business should be refused until it has been demonstrated that acceptance would result in discrimination or in a loss in net revenue which could not be recovered within a reasonable time, and which would therefore have to be absorbed by other customers.

Many industrial concerns have found that sales prices which at the time seemed but bare cost later became very profitable because of the incentive which the new volume of business gave to efforts to obtain lower operating costs. Promotional forms of rates have been used for years by power companies; the idea itself is not new, but its extension to meet extreme conditions requires courage. If the power companies are not permitted to assume any risks whatever in taking on some of these larger process-steam loads they may expect an expansion of some of these large industrial plants to the point where their low production costs and surplus power will make them believe they can serve not only the principal industry on whose premises they are constructed but also supply power and steam to nearby industries at mutual profit. Then certain customers who have been willing to buy power from the utility because of their unwillingness to make capital investments in power plants may find it more economical to buy from their industrial neighbors than from the power company.

Unless the utilities make an earnest and energetic effort to assume the responsibility for these large power and steam loads in concentrated industrial areas they may look for increasing inroads upon their present business in these same areas.

Buying when you cannot sell

It is not always possible to undersell some of these process-steam loads, particularly when the steam load far outweighs the electrical loads. On the field of honor they say that discretion is sometimes the better part of valor. So, too, when you find it impossible to sell it may be more profitable to buy.

Managements of some power companies have overlooked the possibility of substantially lowering their own power production costs by taking advantage of the process-steam loads of some of their largest prospects or customers. High-pressure plants built around the large process-steam requirements of certain industrials may frequently be built for less investment per kilowatt of installed capacity and operated with lower increment production costs than the most modern central station. Frequently these plants can be operated with less additional labor than a central station of equal capacity. Furthermore, the output of such a plant can generally be absorbed within a short radius of the plant, without the necessity of high-voltage substations to feed the energy out into the transmission lines.

Consider such a case as the following:

An industrial plant was making its own power and steam requirements at an annual cost of approximately $750,000 and the utility was unable to sell these power requirements because its own total plant costs, exclusive of distribution expenses in their broad sense, were approximately $0.008 per kilowatt-hour, while the industrial's *increment* cost of energy above the cost of process steam was only $0.005 per kilowatt-hour. The annual usage of process steam was in excess of 1,750,000,000 lb. The construction of a joint plant operating at 1,250 lb. and supplying process steam at both 200 lb. and 25 lb. would enable the steam and power to be furnished to the industrial at no more than its former cost and to yield 45,000,000 kw.-hr. of surplus energy which could be sold to the utility at $0.004 per kilowatt-hour, a saving of $150,000 per year or one-half the cost of production of the same amount of power by the utility. Or, if the utility preferred to make the investment, it would be in a position to supply all the power and steam requirements of the industrial at a saving of 20 per cent under the former costs.

The construction of this plant would provide sufficient firm power to the utility so that it would not have to build any extensions to its condensing plants for another three to five years—a clear economic saving to the community. The profit possibilities of such a joint plant are greater than can be expected from any foreseen improvements in central-station design, using condensing equipment and conventional heat cycles. Such joint plants permanently bind together the interests of the utility and its largest customers, a highly desirable thing, lending increased stability to both the industrial and the utility.

Not every concern using process steam is a prospect for a joint plant, but there are enough large, substantial industrials whose steam load is constant enough throughout the year to justify a considerable number of joint undertakings.

Up to a few years ago additional generating capacity of central stations was generally added in blocks of 35,000 kw. to 75,000 kw. The rate of growth of utility systems, combined with the rapid obsolescence of many existing stations, made such large increments of generating capacity economical. Today, however, utilities are faced with a greatly retarded rate of growth of system load and the percentage of available generating capacity in modern units is far greater than it was a few years back. For this reason increments of generating capacity to be added in the near future by most companies may profitably be of the order of 10,000 kw. to 15,000 kw., or even less, if high economy can be maintained. This radical change in the nature of load growth makes the possibility of 5,000 kw. to 15,000 kw. installations in joint industrial plants very attractive.

In one city the construction of only one of these joint plants, utilizing the process steam of only one industrial, will provide the central station with all the added capacity and increased energy output it is estimated it will require for the next seven years. The full use of such possibilities would in many districts put off the need for further central-station building for several years. In many cities the entire normal growth of the power company's load could be taken care of by the judicious building of joint power and steam plants in those industries and industrial areas where large and steady use is made of process steam.

It sometimes happens with a prospect using large quantities of process steam that the utility is not in a

position immediately to construct a joint plant for the supply of both steam and power, but still wishes to take over the power load and to assist the industrial in avoiding the necessity of adding any additional steam or electric generating equipment for plant growth. In such situations it may be possible and desirable to lease the electrical capacity of the plant at a price that will benefit the customer, save the utility capital investment and yield the utility a comfortable margin above operating costs for the power supplied the industrial. The maintenance of the customer's plant in condition to carry its own load when requested relieves the utility of providing firm capacity for this load. This arrangement, usually made for a short term and for only the largest and best-equipped plants, enables the utility to sell this load at a profit and to get closer to the customer and to be in a better position later to work out a joint plant when the utility needs additional capacity and can absorb the output of such a plant.

Precautions to observe

When making leases or incorporating their features in a tariff for the electrical capacity of a customer's plant it is well to bear in mind that such a lease, if made on the basis of so much per kilowatt of installed capacity, becomes a flat rental and does not vary with the amount of power purchased. Should the customer's electrical takings fall off materially the lease may prove burdensome to the utility. Provision should be made for such a contingency when drawing the lease. One way is to make the rental payments bear a definite relation to the amount of power purchased or to the maximum demand created by the customer, and the utility should be protected by an adequate minimum charge to cover its own risks should the customer fail to continue to use power and to provide firm capacity.

It should be obvious that lease agreements should be entered into only for large loads where the utility rates (including demand charges) are above the customer's actual costs but where the customer's costs in themselves are above the utility's operating cost or out-of-pocket expense. So long as the customer maintains his plant in readiness to carry his entire load the utility is relieved of specific capacity charges for this load. The out-of-pocket profit on such a transaction goes toward the payment of carrying charges on the utility's existing facilities and thereby reduces the overhead on all other customers. A transaction such as this cannot but help ultimately to reduce the cost of producing power and consequently power rates themselves. The size of power loads involved in lease agreements is generally much larger than that of the average customer and the possibility of discrimination is therefore non-existent.

Commissions have given favorable consideration to such arrangements with large customers as herein outlined when the benefits were shared between the utility and the customer, where the same arrangement is made available to others meeting the same conditions and where other classes of customers would be benefited rather than injured.

The utility as a common carrier

Utilities have found it profitable in many cases to supply steam as well as electricity to those industrials whose heat balance made it otherwise difficult for them to use purchased power economically. In other situations the utility has found it profitable to purchase excess energy from large process-steam industries which could not be induced to buy power. In still other localities interchange of steam and electricity between utility and industrial has been effected with benefit to both parties. This idea has grown in acceptance until nearly every large industrial area is being considered as a possible field for the extension of some plan of interchange of energy between the utility and its largest process-steam customers and prospects.

There is a further development of the idea of the mutual exchange and control of power supply and distribution in industrial areas wherein the utility plays the rôle of a common carrier of energy. Consider a situation wherein a number of process-steam industries are unable to buy all of their requirements and where the utility is unable to absorb all of the surplus energy from any one of these industrials; in other words, where a joint plant has not been found feasible. If these industrials were to pool their power facilities and interchange with each other certain economies might be realized, dependent upon the diversity between this limited number of individual loads. However, the investment required to accomplish such an interchange, together with the physical and legal complications, would generally be such as to discourage the practical carrying out of such a plan. An especially difficult obstacle frequently met with in such a proposed undertaking would be the uncertainty of the continued operation of some one or more of the largest industrials of the group. In other words, there would be a certain risk of loss of large steam or electric loads due to seasonal variations or to manufacturing difficulties which might affect certain of these plants.

If now the utility enters the picture as a distributor or common carrier of steam and/or electric energy and is able to act as the medium of exchange of energy between the various industrials it should be able to take advantage of the great diversity between its entire system load and that of the industrials—a diversity greater than would exist between the industrials themselves. Furthermore, the utility is generally in a position to provide the facilities for interchange of energy in a given industrial area and is already authorized as the legal agent for distribution of energy so that it should be able to carry out promptly and satisfactorily any plan that had been demonstrated to be economically sound.

With the utility acting as a common carrier under the conditions outlined above, the problem of compensation could be solved by considering the utility as an agent for the industrials concerned, in which case it would be paid fixed charges on investment involved and for its services in bringing about and conducting the interchange. Or its compensation might be based upon the combined benefits to all parties concerned. It may work out a basis for the interchange of steam and electric energy between individual industrials and itself at rates that take into account the benefits of the combined operation and that distribute those benefits in an equitable proportion to the contributions made by the various industrial loads. These rates should also yield the utility some additional profit in consideration of any risk and investment assumed by it.

This plan of considering the utility as a common carrier and the large industrial prospects (whose business is otherwise unobtainable) as shippers may be the sim-

plest method yet proposed of bringing the utility into actual physical and commercial contact with many of its largest prospects who have heretofore been unwilling to do business directly with the utility, but who would be interested in entering a power pool in which certain large industrials supplied most of the power but in which the utility served as the medium of interchange.

The utility business is no longer a monopoly. It must meet competition and must not shirk its duty to serve any substantial load that can be served profitably. In this way only can rates be reduced to constantly lower levels to the benefit of all classes of customers.

Process steam industries offer the power companies the greatest single opportunity for large-scale commercial development that exists today.

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Compensated Divider Needed for Time Surge Measurement

By C. M. FOUST

General Electric Company, Schenectady, N. Y.

A sound understanding of the impulse voltage strengths of insulation materials and assemblies is essential to their proper use in apparatus or equipment. Impulse tests in the laboratory are relied upon to provide these values and confidence in such tests accrues to just the extent that a thorough control of test conditions is achieved.

The test waves produced by the impulse generator are millions of volts in amplitude and millionths of a second in time duration. The waves commonly used at present are ($\frac{1}{2}$–5), (1–10) and ($1\frac{1}{2}$–40). The first figure gives time to crest voltage and the second time to one-half crest voltage on the wave, both measured from zero time. These wave shapes are recorded by the cathode-ray oscillograph.

Probably the most difficult problem in the impulse testing technique of recent years has been that of connecting, for wave shape registrations, the very sensitive cathode-ray oscillograph to the extremely high-voltage, high-power impulse generator. The millions of volts generator output must be stepped down below 1,000 volts for application to the deflection plates of the cathode-ray oscillograph. The power dissipation in the impulse generator discharge circuit may be several million kilowatts, while the oscillograph requires only charging current for a pair of deflection plates of some 10 micro-mfd. capacitance, or a rough equivalent of 5 watts. In other words, the power to produce oscillograph deflection is about one-millionth the power consumption of the discharge circuit.

A method of oscillograph connection to the impulse generator at present used in several laboratories is shown in Fig. 1. This arrangement is called the resistance-cable voltage divider and is used where it is found necessary to locate the cathode-ray oscillograph at some point remote from the impulse generator. A voltage division equal to $\frac{R_3}{Z}$, where Z is the surge impedance of the cable or $\sqrt{\frac{L}{C}}$, is obtained. The resistance R_4 must be equal to Z to prevent reflections at the cable terminal.

A laboratory study on such a voltage divider is shown in Fig. 2. The cable selected for use had a surge impedance of approximately 25 ohms by calculation. The discharge circuit C_1, R_1, R_2 and C_2 was arranged to give a smooth ($\frac{1}{2}$–5) wave as checked by calculations and other types of voltage dividers. For experimental purposes the resistance R_4 was adjusted over a wide range of values above and below 25 ohms. Oscillograms

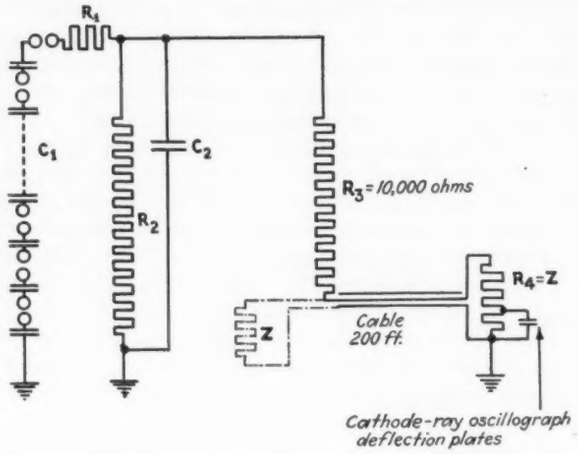

Fig. 1— Resistance-cable divider gives true wave reproduction

Impulse generator circuit consists of C_1, R_1, R_2 and C_2. Voltage divider for oscillograph consist of R_3, the cable and R_4. Divider ratio is R_3/Z where Z is surge impedance of the cable, equaled by R_4 and the bridging surge impedance shown dotted.

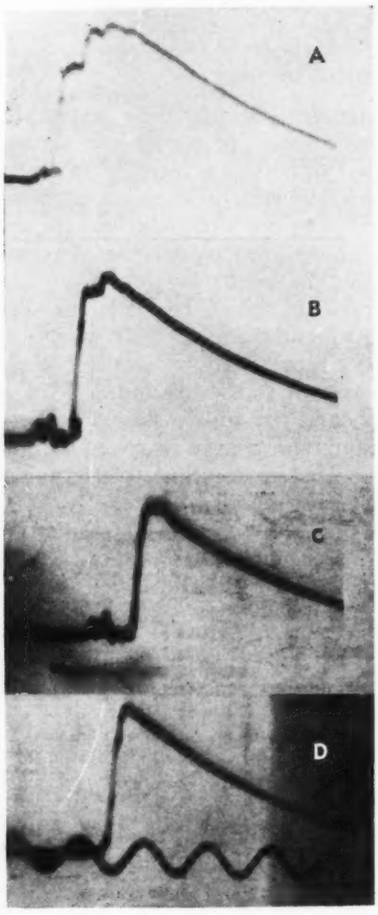

Fig. 2— Compensated divider gives fidelity on all waves

Unfavorable resistance (R_4) adjustment (A, 60 ohms, and B, 30 ohms) gives reflections which are eliminated when R_4 in C is made 22 ohms. Duplicating R_4 at the other end of the cable as in Fig. 1 enables oscillograph to record true $\frac{1}{2}$-5 wave. Timing wave is 500,000 cycles.

A and *B* of Fig. 2 taken at 60 and 30 ohms respectively show the applied voltage wave with several voltage reflections superimposed. These reflections took place first at the oscillograph and then returned to the deflection plates, after reflecting at the generator end of the cable. Oscillogram *C* was taken at 22 ohms and showed a practical elimination of the voltage reflections of *A* and *B*. However, the true ($\frac{1}{2}$–5) applied wave was not recorded and further adjustment of R_4 proved of no avail. Through further study of the oscillograms the conclusion was reached that the junction point of the 10,000-ohm resistor and the cable should also be bridged by a surge impedance (dotted lines in Fig. 1). Oscillogram *D* was taken after this resistor was connected and it will be noted that the ($\frac{1}{2}$–5) wave is now faithfully reproduced.

A voltage divider is satisfactory only when it properly registers waves of various shape and any oscillations which may be superimposed. A good check on a divider is a voltage calibration of the cathode-ray oscillograph on two different wave shapes. The oscillograph deflection should be the same for each wave if the impulse generator output voltage as indicated by sphere gaps is the same. Such a calibration was taken using the resistance-cable divider as shown in Fig. 1 and Fig. 2*D*. The results were as follows:

Wave Shape	Voltage Divider Type	Impulse Generator Voltage Corrected	Oscillograph Deflection Millimeters	Kv./mm.
($\frac{1}{2}$-5)	resistance-cable	593	26.0	22.80
(1$\frac{1}{2}$-40)	resistance-cable	594	26.0	22.84

These data show an excellent check of oscillograph sensitivity for the two waves. As the sphere spark gap used for voltage measurement is accurate within 3 per cent and the measurement of oscillogram deflection introduces some error, any check within 5 per cent is satisfactory. This study of resistance-cable voltage divider shows that when careful adjustment of cable surge impedance is made and both ends of the cable are bridged by such an impedance the divider may be successfully used for the impulse testing waves which are now common.

This study of voltage divider performance is typical of work being conducted in several laboratories and illustrates the careful attention to details required to justify confidence in the results of such work.

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Cost Analysis of Experimental Underground Rural Line*

During the fall of 1931, as an experimental installation, 2.35 miles of underground rural line was constructed at a cost, *excluding* transformers, services and meters, of $1,610.54 per mile and a total cost, including transformers, services and meters, of $1,904.19 per mile. This was a single-phase, 4,000-volt line using No. 6 concentric cable. Trenching was done by local labor at 4 cents per foot.

Poles		
Material:		
1 50-ft. cedar pole	$29.40	
4 six-pin crossarms	10.24	
4 No. 502 insulators	0.52	
Miscellaneous material	13.89	
	$54.05	
Credit miscellaneous mater'l	2.42	
	$51.63	
Labor	46.40	
Transportation	4.20	
Total		$102.23
Underground conduits		
Material:		
110-ft. 2-in. black steel pipe	$19.80	
Miscellaneous material	0.68	
	$20.48	
Labor	118.57	
Transportation	76.10	
Total		$215.15
Underground conductors		
Material:		
14,190 ft. No. 6 solid 11/64 in. rubber insulated tape serving of 24 x No. 19 bare wires, calk, asbestos braid, saturated calk, jute serving, 5,000-volt concentric cable	$1,426.02	
12 split joint boxes	35.82	
10 splicing kits	13.66	
8 gal. ozite compound	9.97	
Miscellaneous	43.24	
	$1,528.71	
Credit (wire, boxes, Ozite)	46.95	
Total of material		$1,481.76
Labor:		
Payroll	$405.65	
Board and lodging (two men)	5.90	
13,335 ft. excavating and backfill by farm labor	609.03	
Repairs to plows	23.00	
		$1,043.58
Transportation		109.13
Total		$2,634.47

Services		
Material:		
700 ft. twin No. 4 standard 600-volt cable	$73.83	
600 ft. solid medium and drawn copper wire	8.05	
	$81.88	
Labor	18.66	
Transportation	6.16	
Total		$106.70
Line Transformers and Devices		
Material.		
65 pieces 1 x 6 — 16 ft. hemlock 520 ft	$20.38	
53 pieces 1 x 6 — 18 ft. hemlock 477 ft	18.70	
16 pieces 1$\frac{1}{2}$ x 3 — 12 ft. spruce 60 ft	3.53	
4 pieces 2 x 4 — 12 ft. spruce 32 ft	1.41	
8 pieces 2 x 4 — 16 ft. spruce 85 ft	3.75	
2 rolls heavy buckskin roofing paper	4.16	
	$51.93	
Miscellaneous credit	10.00	
	$41.93	
20 lb. 4d box nails	1.37	
7 pairs 6-in. strap hinges	1.03	
7 4$\frac{1}{2}$-in. safety hasps	1.37	
	$45.70	
7 precast foundation slabs	51.40	
10 E.P. 45 x 6 fuse boxes	41.70	
1 E.P. 375 cutout	10.63	
Miscellaneous	44.50	
	193.93	
Credit	.64	
	$193.29	
Labor	99.52	
Transportation	27.30	
Total		$320.11
Right-of-Way		
Payroll and expenses		$87.20

Stores Expense		6.38
Engineering		
Payroll	$141.48	
Transportation	10.27	
Expenses	5.70	
Total		$157.45
Overheads†		
Compensation insurance	$31.22	
Interest	18.19	
Miscellaneous construction expense	105.67	
Total		$155.08
Cost of job, exclusive of transformers and meters	$3,784.77	
Summary		
Right-of-way	$87.20	
Material	1,829.04	
Labor	1,326.73	
Transportation	222.89	
Stores, engineering and overheads	318.91	
	$3,784.77	
Cost per mile exclusive of transformers and meters	1,610.54	
Cost of meters, meter installation and transformers not included above or in job estimate:		
Cost of meter installation —		
Labor	$6.00	
Transportation	7.57	
Cost of meters	41.85	
Cost of transformers (8)	634.66	
		$690.08
Grand total		$4,474.85
Total cost per mile		**$1,904.19**

† It should be noted that the item of overhead charges has not been divided, but has been charged in full to the line exclusive of transformers, services and meters.

**Fourth and last installment of report of electric technical committee on construction standards and cost of rural distribution lines, Empire State Gas and Electric Association. See* ELECTRICAL WORLD, *Oct. 8, page 507; Oct. 15, page 526; Nov. 19, page 698.*

Economic Benefits of Scientific Line Clearing

By T. H. HAINES* and E. F. ROBINSON†

FIVE years of scientific line clearing on the Boston Edison system has decreased service interruptions, reduced safety hazards due to fallen wires, lessened reports of interference with radio reception and practically eliminated complaints from property owners. Measured in units of wires down per 100 street-miles of lines per year due to trees, the past five years' operations show a decrease of from 14.3 to 5.9, or 59 per cent. The total cost of line clearing in 1927 on 1,900 miles of streets was $115,505, whereas this was cut to $104,221 for 2,111 miles of streets in 1931. The use of tree experts has played a vital part in attaining these results.

The Boston company distributes electrical energy in 40 municipalities, embracing 650 square miles. A total of 130,000 overhead services and 30,000 overhead fed street lights are supplied by 2,111 street miles of pole lines.

In general, the primary distribution system is radial in type and operates at 2,300/4,000 volts, three-phase, four-wire, with the neutral ungrounded. There are 7,300 overhead single-phase transformers connected between the neutral and phase wires. The secondary distribution consists of 115/230-volt, single-phase and 230/460/575-volt, three-phase systems. Most of the street-lighting plant is composed of 6.6-amp. series circuits operating at a maximum pressure of 5,000 volts. These various systems include 15,000 miles of line wire which pass through or under the branches of a veritable forest of 250,000 trees, an average density of 118 trees per mile.‡

These 250,000 trees are classified roughly as 45 per cent elms, 25 per cent rock maples, 10 per cent Norway maples, 5 per cent silver maples (soft), 10 per cent oaks and 5 per cent miscellaneous, consisting of hickories, pines, poplars and very few spruce.

The trees in general are large and matured, the greater part of them having been planted by the early settlers. As a result of the beauty, history and sentiment attached to these "first citizens," the average New Englander is conservatively and extremely "tree-conscious,"

Before the fall of 1926 all tree trimming was done by linemen. Linemen are trained in climbing poles and other rigid structures, and with few exceptions dislike climbing trees. They were not familiar with the habits of the different species of trees and the proper scientific methods of trimming them. They naturally found it extremely difficult to tell dead wood from live wood, except when the trees were in foliage. This and their subordinate interest in the trees often caused complaints from the public, the linemen making the best of a difficult problem.

They, of course, used spurs, although this was not proper as short ladders and ropes are preferred for obvious reasons. The cuts were made hastily and sometimes rather questionably, and no attention was given anything but the matter of immediate "fair weather" clearance. Where permission to trim was refused or compromising, tree wire was the poor alternative. This provided only temporary relief, as the insulation, while superior to that of ordinary line wire, was subjected to the same conditions and eventually broke down.

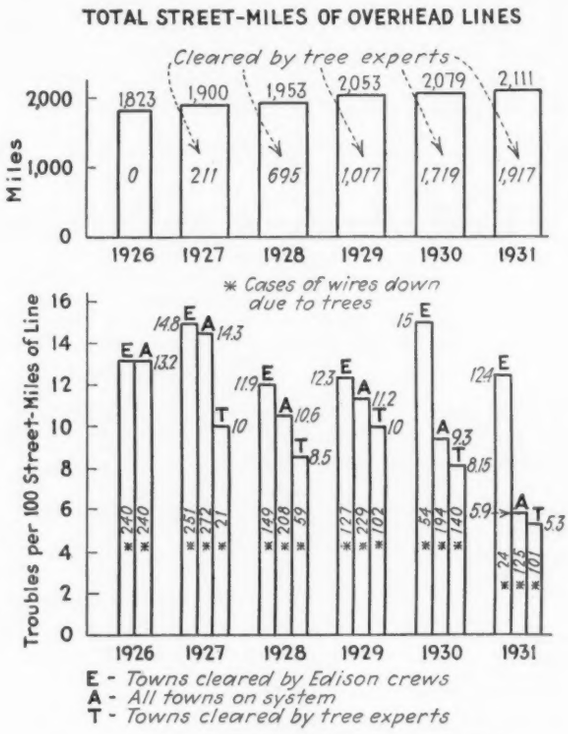


Fig. 1—Expert tree trimming reduced wire troubles from trees

In the fall of 1926 experts of a national tree surgery organization were assigned to clear the lines in one city, and in the summer of 1927 another large organization doing private work started operations in a second. This was the beginning of an experiment based on the theory that tree surgeons would (1) obtain only the necessary clearance, much of which would be permanent, at a minimum cost without sacrifice to the trees, and (2) effect a direct improvement in public relations as a result of

*Superintendent Distribution Department, Boston Edison Company. †Distribution Engineer, Boston Edison Company.

‡Both sides of street. Definition of a tree—4 in. diameter breast high.

higher standards of service and the improved conditions of the trees.

The immediate impressions were that the experiment was to be a success, and a third company was enrolled in the work. At the end of 1931 these three companies were responsible for more than 90 per cent of the system's 2,111 miles of pole line. The procedure has been to do as much virgin clearing as possible by towns, and then, if possible, at the end of two calendar years, to give the town a thorough retrim. The large amount of virgin trimming being done, however, has very often made it necessary to let a town go more than two calendar years. Many have gone three and four growing seasons before being retrimmed.

All phases of the line clearing have been under constant surveillance. The important objective was the determining of definite measures of results from operating and economic standpoints. This was accomplished by means of the "trouble dispatcher's daily reports" and the "miscellaneous trouble analyses," which include a detailed description of each fault and its cause. These analyses are made by representatives of the tree expert companies and a representative of the technical division of the distribution department.

"The number of cases of wires down per 100 street-miles of lines per year due to trees" was selected as a very definite measure from an operating standpoint and also from the standpoint of safety. With this as a ratio, a graph of three sections was made of the trouble rates of each of the last six years (Fig. 1).

This graph shows that there has been a gradual downward trend in the wires down per 100 miles from tree causes since the services of tree surgeons were utilized. In the first year plotted, 1926, there were 13.2 such troubles per 100 street-miles of line and a total of 240 cases of wires down for tree causes. No rate for tree experts was given for that year as the work done was performed during the last six weeks of the year, and the transfer of responsibility for a town's trouble is determined by the growing season following the first trimming.

The year 1927 found the rate for all towns 14.3; for towns cleared by Edison crews 14.8, and tree experts' towns down to 10. The rates for the next year were: Edison crews, 11.9; all towns, 10.6, and experts' towns, 8.5. In 1929, probably as a result of many wind, rain and sleet storms, all rates went up a bit, being 12.3, 11.2 and 10 respectively. This increase in the tree experts' rate may be due in part to not doing the necessary retrimming. The rate of trouble in 1930 went down to 9.3 for all towns, as a result of the tree experts being responsible for more than 80 per cent of the system. The tree experts' rate was 8.15, in spite of an increase in the rate of trouble in the towns cleared by company line crews.

The downward trend continued in 1931 with a drop in trouble for all towns to 5.9, tree experts' towns, 5.3, and company crews, 12.4. This was a reduction in all the territory of almost 40 per cent. In five years' operations the tree experts' mileage cleared showed a trouble reduction of 62 per cent.

As a result of the extensive program being followed and the keen spirit of competition between the forces doing the line clearing, it was considered desirable to compare the results obtained by the tree surgeons' organizations. This was done by using the same measure of trouble and is presented on a yearly basis in Fig. 2. It is noteworthy that the tree experts' work produced a rapid improvement in service, whereas the company line crews realized minor gains in the face of the decreasing volume of clearing required of them.

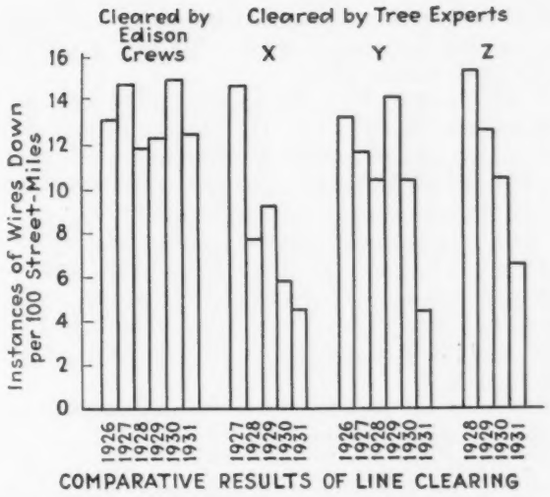


Fig. 2—Competing tree surgeons improved service as system experience lengthened

In order to justify the use of the experts from an economic standpoint, a comparison was made of the annual costs of insulating conductors from trees by means of trimming and tree wire. This cost analysis is on a mileage basis and appears in the accompanying table. It is presented graphically in Fig. 3.

The first bar in each year shows the average cost per mile of insulating. This figure was computed by adding to the cost of trimming the cost of tree wire plus 10 per cent for installing it, and the two have been separated in each bar to show the decrease in the use of tree wire, which is attributed to the success of the line-clearing program.

The total average cost per mile ranges from $47 in 1926 to a peak of $70 in 1928 and 1929, decreasing to $61 and $49 per mile in 1930 and 1931 respectively.

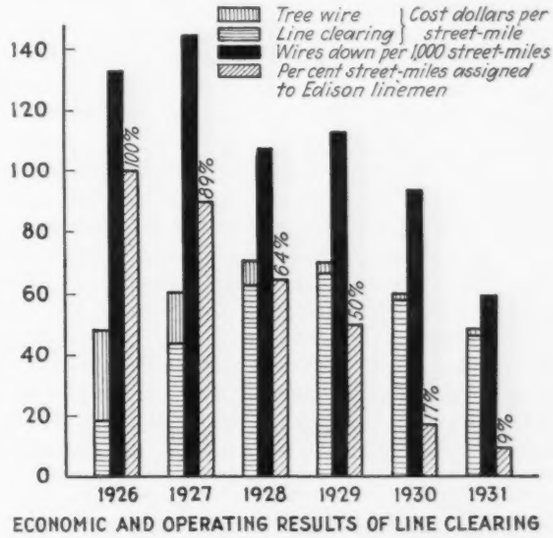


Fig. 3—Cost of clearing per street-mile is gradually diminishing

It is of interest to note that the amount of tree wire installed has decreased from $30 per mile in 1926 to less than $2 per mile in 1931.

In 1926 and in 1927 the seemingly low cost per mile is due to two factors: (1) The absence of any overhead charges to approximately $30,000 worth of line crew labor in each of those years, and (2) the rather inexperienced maintenance of the system with regard to tree conditions as evidenced by the number of cases of wires down, which is presented in the second bar of each year.

If an overhead of 40 per cent were added to the labor cost of line crews the average costs per mile in 1926 and 1927 would be $54 and $66, or $6 and $18 more per mile than in 1931.

The third bar denotes the percentage decrease of the miles assigned to the line crews.

The worn-out phrase "cost per tree" means very little in itself and is not used for comparative purposes unless properly qualified. This factor varies with the number of trees per mile, whether it is a first, second or third maintenance trim, and last, but not least, the definition of a tree. To be recognized as a unit on this system, a tree must measure 4 in. in diameter breast high. In the last six years the cost per tree per year has been 44 cents. The cost per tree on virgin trimming (first trim) has varied from $3 to $0.80 per tree in towns whose tree density varies from 35 to 200 trees trimmed per mile on both sides of street. The average cost per mile per year for the past five years is $55.

Economics of Line Clearing

Boston Edison Company

Cost	1926	1927	1928	1929	1930	1931
Tree experts.....	$5,758*	$51,564	$88,935	$112,200	$105,269	$93,433
Edison crews.....	28,166	30,336	32,765	25,000	15,231	4,738
Total labor.....	$33,924	$81,900	$121,700	$137,200	$121,500	$98,171
Tree wire.....	$47,500	$30,550	$12,050	$6,800	$5,500	$5,500
10 per cent installation.....	4,750	3,055	1,205	680	550	550
Total wire.....	$52,200	$33,605	$13,255	$7,480	$6,050	$6,050
Total.....	$86,124	$115,505	$134,955	$144,680	$127,550	$104,221
Miles of streets (overhead).....	1,823	1,900	1,953	2,053	2,079	2,111
Tree wire cost per mile.....	$28.62	$17.69	$6.79	$3.64	$2.91	$2.87
Trimming cost per mile.....	$18.61	$43.10	$62.31	$66.83	$58.44	$46.50
Total tree insulating cost per mile.....	$47.23	$60.79	$69.10	$70.47	$61.35	$49.37

*Six weeks' service.

On construction and small maintenance jobs the costs are compared on a per-section and per-tree basis.

Each city and town appoints or elects a forester or tree warden, to whom is delegated complete responsibility for the trees. The warden reigns supreme by virtue of a Massachusetts law enacted many years ago, which reads to the effect that only a tree warden or his deputy may cut, trim or remove trees along the highway. This is interpreted liberally, however, and the utilities operate with the warden acting as a supervisor of the actual work. We have found the wardens very co-operative and progressive, and with only two exceptions have enjoyed mutual satisfaction and agreement with our line-clearing program for the last few years. These two exceptions are the result of the tree warden's refusal to allow tree experts to do the work. One permits them on construction jobs only; the other refuses even to try them.

These two towns have consistently experienced wires down at rates far in excess of those of any other towns. It is hoped our sincere interests in the welfare of the trees will be recognized and that the mutual advantages offered by our line-clearing program will be accepted.

From the standpoint of the tree owner, the program has had unusual success. In the days of trimming with linemen complaints were very frequent and sometimes severe. In 1931 no complaints were received from property owners, while letters and other expressions of appreciation were received.

The foundation for the company's specifications for line clearing is the use of only those actual tree expert companies that are established in private estate tree maintenance. This is for two fundamentally important reasons: (1) The men assigned to the tree work of the insulating operations by this type of service organization are thoroughly trained and experienced in the proper care of trees. These men have a greater natural tendency than linemen have to treat the trees in the manner desired by the public and have the reputations of their companies to uphold as well as to obtain the clearance for and eliminate hazards to the wires; (2) private permissions are secured with the least effort and restriction by these organizations as they have the confidence of the property owners.

The tree service companies are required to carry the customary forms of insurance and adhere to the same safety-first rules that apply to the utility's men.

It has been discovered that trimming on a two-year or three-year frequency, as conditions demand, with crews composed of a foreman, six climbers, a combination truck driver and groundman and, in a few cases, another groundman, produces the best results. Realizing the advantages of straight-line production and the importance of avoiding turnover in skilled labor, we have exercised control over the number of crews in order to operate a bit undermanned and as continuously as possible with approximately the same personnel.

The detail work specifications require the removal of all dead wood that is considered a plant hazard, whether it is just over the wires or 100 ft. off to one side. This particular requirement is the result of an analysis of causes of wires down, which showed that before the first trim more than 60 per cent of the wires down were due to dead wood.

Tree troubles, like most other line difficulties, practically always occur during abnormal weather. Therefore, clearance requirements are designed to provide a maximum of relief during stormy weather. "Fair weather clearance" was the old school idea. Today the expert visualizes the behavior of each tree under stress of wind, snow, sleet or rain, and treats it accordingly. The old theory that primaries should receive so many feet of clearance, secondaries so many feet, and so on, is a fallacy. Different species of trees and the same specie of trees in different environments grow varying distances in the same time, to say nothing of behaving differently under storm conditions. We have not attempted to dictate any policy in this respect, but have always considered it the responsibility of the tree experts. It is their practice to consider each tree an individual problem.

All tree insulators which can be eliminated as a result of the clearing are removed by the experts and salvaged if modern. This is done with the lines energized and by using the necessary protective equipment.

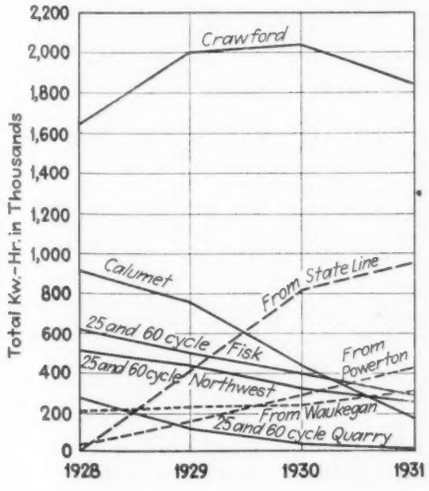
The quality of the workmanship must be of the highest standard and meet the approval of the municipal authorities and the utility representative. One important demand is for flush cuts and the removal of old short stubs above the wires. Another is the shaping and balancing up of the tree to compensate for any removal of branches. This procedure cannot help but leave the trees in a more healthful and a safer condition.

Inspection and defect reports

During the progress of the work the tree expert foremen report to the division head concerned any defects, such as slack or worn wires, broken insulators or pins, the need for tree insulators, etc. These defects are taken care of as conditions demand. In one division maintenance has been so arranged that a line crew works behind the tree crew on a definite schedule. In this manner the follow-up crew incurs no additional expense due to duplication of travel and maximum protection is afforded the territory. The procedure is gradually being adopted in other divisions, and will eventually become standard practice.

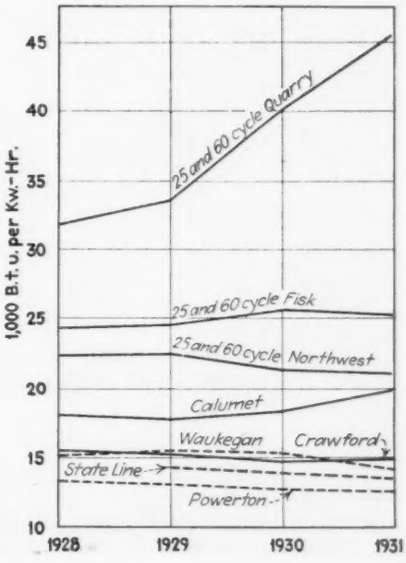
After a town has had two thorough trims and a growing season has gone by a crew is sent in to "high spot" it. This "high spotting" is nothing but the removal of sucker growth and any immediate plant hazards and has an economic advantage in that it lengthens the time between regular trims by at least one growing season. From this practice we expect (1) a greater decrease in system troubles; (2) the regular trimming cycle will be lengthened by one year under ordinary conditions; (3) costs will be reduced at least 15 per cent over a period of years.

Tree insulators up to now have always been installed by company linemen. The tree experts have removed all unnecessary ones. In June, 1931, the theory was advanced that if these men can with safety remove insulators from live lines they could reverse the process and install insulators in those locations which they would ordinarily report to the utility division head, and thus reduce the labor of this work by more than 50 per cent. This has been carried on as an experiment by one crew in one division since then and has proved a success. As the use of tree insulators is only a last resort, and as the ability to determine the need for them is the result of experience, it will be a matter of time before this is considered for adoption as a regular procedure.



Chicago energy increasingly supplied from outside the city

State Line, Powerton and Waukegan stations are located outside of Chicago. Because of better economy in these newer stations, as shown by the graph of thermal efficiencies, the city load is more and more fed from them.



Thermal efficiencies of generating stations in Chicago district

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Local vs. District Generation for Quality Service

How much remains to be done in improving the reliability of electricity transmission is strikingly shown by the following excerpt from a paper on "Chicago's Bulk Power Supply" to the national power systems engineering committee by G. M. Armbrust and T. G. LeClair, Commonwealth Edison Company. On the basis of running capacity taken out by interruptions the ratio of service quality of distant to local generation is of the order of 60 to 1:

"The standard of service on supply capacity to Chicago is distinctly different, depending on whether the capacity units are inside or outside the city. In 1931 the 132-kv. overhead system was supplying Chicago, on the average, the equivalent of about 305,000 kw. in steam capacity. On this capacity there were 38 partial interruptions which dropped a total of 1,917,000 kw. steam capacity, or 6.3 times the average running. Inside the city the average running capacity as part of the supply to the same load was 775,000 kw., but on this capacity there were only three interruptions taking out a total of 85,000 kw. of steam supply, or 0.11 times the average running capacity. These may be unusual figures, but they give some idea of the relative dependability of local and distant capacity. None of these interruptions interfered with customer service, but they required running reserve inside the city.

"It has been expected for some years past that there would be an increasing proportion of the Chicago energy generated in stations outside the city. This proportion of energy has increased much more rapidly than expected (see charts). In 1928 the energy used in Chicago was generated 94 per cent within the city and 6 per cent outside, while in 1931 energy purchased from outside stations had increased to 39 per cent. Hence the problem of securing reliable service on these overhead transmission lines is continually and rapidly increasing in importance."

Guarding Remote Control Against

By G. H. LANDIS* and H. A. McLAUGHLIN†

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LENGTHY interruptions to an important load center supplied from a remotely controlled transmission substation made it necessary to devise a "hook-up" for preventing operating faults resulting from failure of the interconnecting control cable. The difficulties encountered, caused by fault currents flowing over the control cable between the remote and control stations, are of unusual interest and have undoubtedly been experienced by many other companies operating remote or supervisory controlled stations. The solution of this problem led to a very interesting combination of remote control and automatic operation which has recently been placed in service at the Boulevard substation of the Central Hudson Gas & Electric Corporation.

Since the installation of the remote control, about three years ago, several ground faults in the Boulevard substation and on the transmission lines near the station have been experienced, causing considerable damage to the remote control system. Indicating lamps were burned out, resistors flashed over, and in one case the connecting control cable was burned off. In every case faulty operations of the switches and breakers occurred.

Analysis of these cases indicated that they were due to a rise in ground potential at Boulevard occasioned by a fault current of some 3,000 amp. through a station ground of approximately 2 ohms. This caused a considerable difference of ground potential during faults between Boulevard and Jansen Avenue. This potential difference would cause a breakdown from ground to the control equipment and over the cable to Jansen Avenue, resulting in damage to equipment and faulty switch operations.

The ground resistance encountered at this station was considered reasonably low for a transmission substation remote from the possibilities of being tied into water mains, streams or other low resistance paths. Previous to remote control operation, no difficulty was experienced with the station grounds. It is apparent, however, with fault currents of the magnitude experienced here that the reductions of the ground resistance to one-half or even one-quarter the existing value would still produce potential rises sufficient to cause difficulties with any interconnecting cable.

Various attempts were made to improve the grounding conditions at Boulevard. These were unsuccessful owing to local conditions, the station plot and surrounding territory consisting of a layer of earth over a stratum of rock. The possibility of tying the grounds of the two stations together through a low resistance connection was considered. This would have limited the potential dif-

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Fig. 2—Multiple switch, lightning arresters, insulating transformer and 19-cycle magneto

Constitute co-ordinated remedy for contral cable failures.

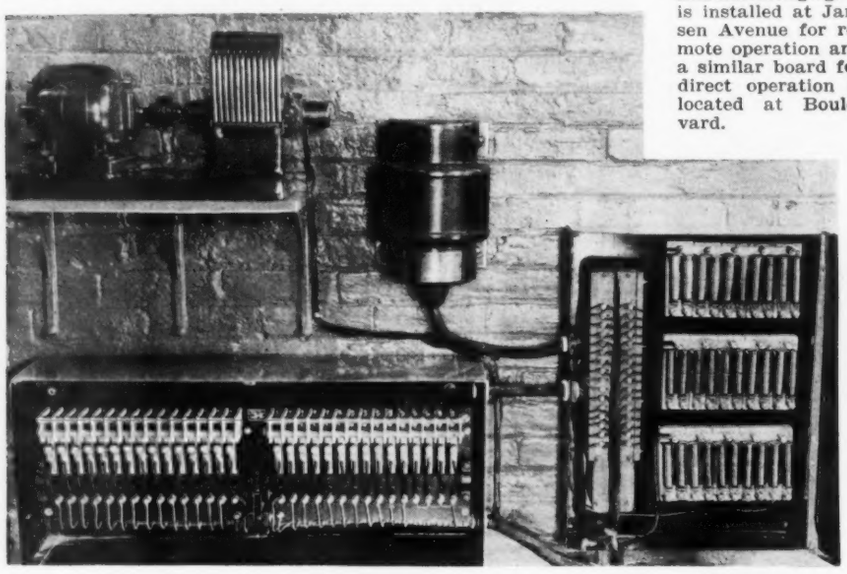
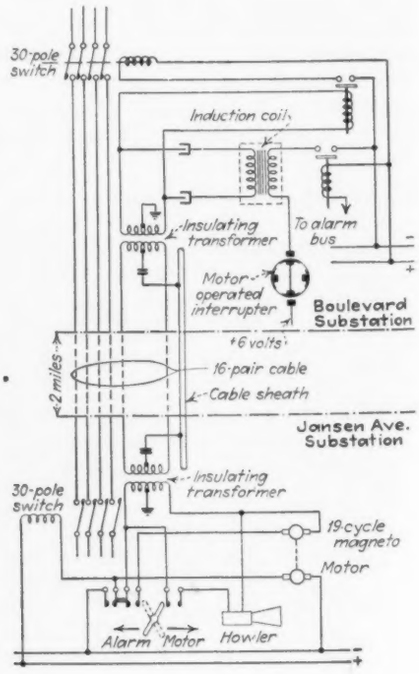


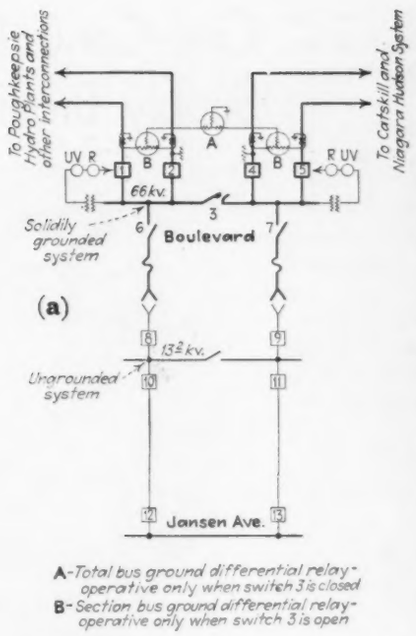
Fig. 1—Control cable opened to prevent flow of ground currents

Boulevard substation, located on the outskirts of Kingston, N. Y., is a two-way automatic sectionalizing point for one of the main double-circuit 66-kv. transmission lines, which extends northward to connect to the power sources of the Niagara Hudson System and southward to connect to various company generating plants and other interconnections. In addition, this station includes two stepdown transformer banks and two 13.2-kv. cables, which form the main supply to the Jansen Avenue substation, a distribution station for the city of Kingston. Boulevard substation is remotely controlled from Jansen Avenue, 2 miles away, over a sixteen-pair lead-covered telephone cable. A miniature board with individual control switches and indicating lights is installed at Jansen Avenue for remote operation and a similar board for direct operation is located at Boulevard.



Ground Faults

ference between the stations. However, because of the comparatively high ground resistance at Jansen Avenue the ground potential at this point would be considerably increased. Since this is a distribution substation, located in the center of the city, this procedure was considered undesirable.



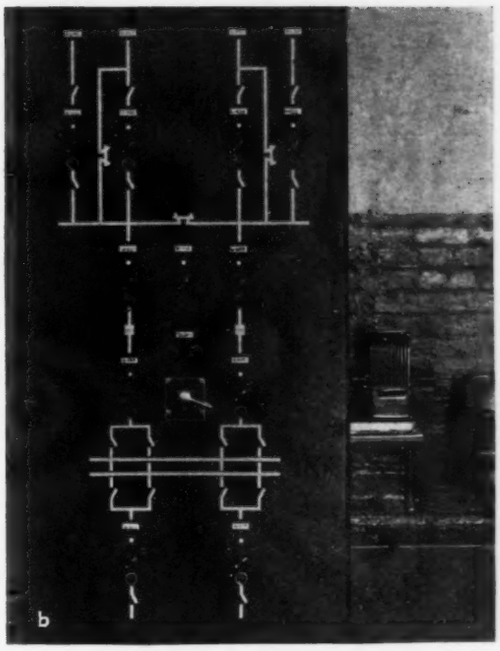


Fig. 3—Scheme guards against faulty reclosures

(a) In the case of a bus fault the sequence of operation is as follows: A total bus ground differential relay trips oil circuit breakers 1, 2, 4, 5, 8 and 9, followed by bus sectionalizing air break switch 3. The tripping of these switches energizes the alarm bus, placing into operation an interrupter with an induction coil, which transmits a pulsating current through the insulating transformers to a "howler" at Jansen Avenue. It is evident that if the operator were to reclose the breakers on a fault with the control cable connected a failure of the control system would result. To prevent this, one breaker on each bus section (1 and 5) is equipped with a reclosing relay which will reclose the breaker once if the bus section is dead. A section bus ground differential relay will then trip the breaker connected to the faulty bus section. The breaker connected to the clear bus section will remain closed.

(b) After a delay to allow the reclosures to take place, the operator closes the control circuit. This is accomplished by turning the switch in the center of the control board, Fig. 3b, from "Alarm" to "Motor." This starts up a 19-cycle motor-driven magneto shown in Figs. 1 and 2, resets the alarm and closes the 30-pole switch at Jansen Avenue. The 19-cycle current flows through the insulating transformers and control pair to Boulevard, through a relay which closes the solenoid circuit actuating the 30-pole switch at the latter station. The operator at Jansen Avenue then has an indication on his miniature board of all switch positions and can restore service without danger of picking up the fault.

In the case of line trouble the operation is similar. No reclosure takes place since the bus remains alive. Right of way is given to the operators at the other ends of the 66-kv. lines to attempt to restore service on the line. After a sufficient interval to allow these operators to restore service the Jansen Avenue operator closes his control circuit and restores line service through the Boulevard substation.

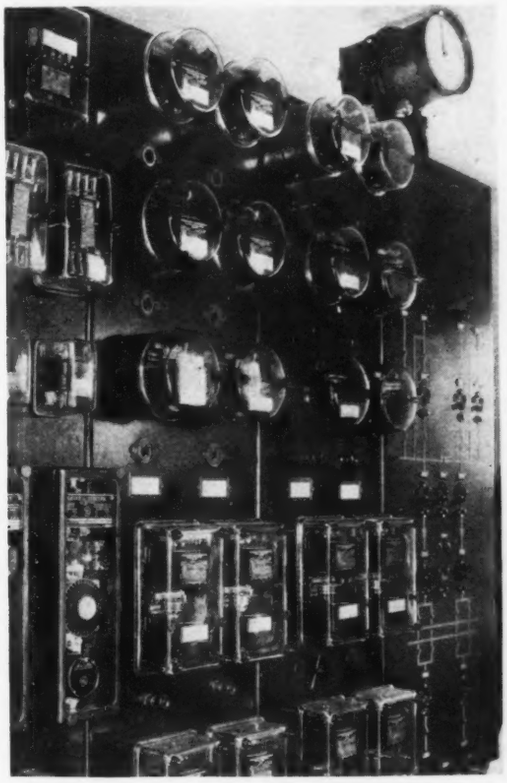


Fig. 4—Local miniature control, and all relays, protective, auxiliary, interlocking, reclosing, on a single board

It therefore appeared necessary to disconnect the control cable between the stations to prevent ground currents flowing to Jansen Avenue. A scheme was developed by which this was accomplished without losing the value of remote control. This scheme has operated successfully both under test faults imposed upon the bus and under actual flashovers which have occurred since it has been placed in operation.

Normally the control cable connecting the two stations is disconnected at each end through a 30-pole solenoid-operated switch, as shown in Figs. 1 and 2, thereby preventing the flow of ground currents. One pair or control wires is connected permanently between the two stations with an insulating transformer on each end of the circuit, as shown in the diagram. The insulating transformers prevent ground current from flowing between the stations, but allow pulsating or alternating current to flow for alarm or control purposes. A pulsating current is applied at Boulevard upon an automatic switch operation, to operate a "howler" at Jansen Avenue, and an alternating current is employed, through an auxiliary relay, to close the 30-pole disconnect switch at Boulevard substation. The operator therefore has immediate indi-

cation of changes in switch positions and can close the control circuit at will to determine the position of his switches. The detailed functioning is described in conjunction with Fig. 3.

At the time this equipment was placed in service a test was conducted by grounding the 66-kv. station bus. Since then several flashovers have occurred during lightning storms, one in particular being the failure of an insulator on the line side disconnect switch of a 66-kv. circuit breaker. In all cases the equipment functioned correctly.

The authors are indebted to Frank Veverka, superintendent of substations, and F. P. Jones, substation design engineer, for their assistance in the design and execution of the work which has made possible the successful remote operation of this substation.

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READERS' FORUM

Flat Rate Used 15 Years in Low-Wage Urban Areas

To the Editor of the ELECTRICAL WORLD:

I have read with interest the article by W. A. Rhodes under Readers' Forum on page 702 of the November 19 issue of ELECTRICAL WORLD on the subject of "Flat Rate Lighting in Low-Wage Urban Areas."

This has been particularly interesting because we have been operating during the past fifteen years just such a service as described. Since this class of business will probably receive much wider attention in the future than it has in the past, some information on our practice will no doubt be of interest to more of your readers.

To begin with, we only render flat-rate lighting service in areas served with multiple street-lighting systems and we connect the flat-rate service to the street-lighting system so that it is turned on just before dusk and turned off just after dawn. We do not serve isolated customers, but groups of houses along a street where one pair of service wires may be taken from the nearest pole through a fused switch to the nearest house and then jumped from house to house along the street. The wiring is all open knob and tube work and is made by the company. Only 10- and 25-watt lamps are used, and although originally we used left-hand thread sockets exclusively, we are now installing the bayonet-base European type sockets, because it was found that the standard lamp or attachment plug could be easily forced into the left-hand thread socket for service.

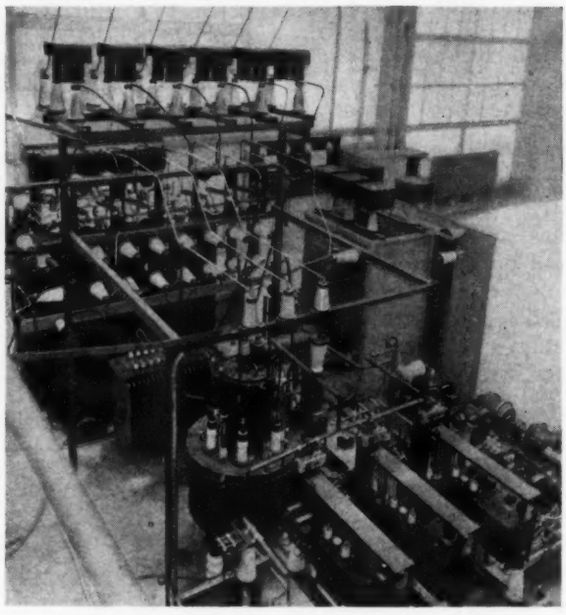
Service is collected for each month in advance, and if the customer fails to pay the collector simply removes half of the rosette with cord, socket and lamp. Collections are not made imperiously on the first or last day of each month, but are pushed on Saturday nights and Sundays at the time the worker has his week's pay. The company furnishes the original bulb free, but the customer must purchase renewals from the company and these are sold to him at slightly under cost. This policy of selling the lamps below cost keeps the renewal problem from becoming a burden to this class of customer and discourages any dealer from stocking these lamps in different sizes, which would create a problem for us. All of these houses are located on the very edge of the street and due to the warm climate are always open in the evening. The employee in charge of service in a town has but to walk along the street, glancing in the doors as he passes, in order to determine whether or not additional lamps, or lamps of a size larger than that contracted for, are being used.

Our standard of service even in the smaller towns is very high and since this requires a constant employee we find that he can handle at least three hundred customers of this class in addition to his other work. In the larger towns, where we have from 500 to 1,200 of these flat-rate customers in each town, it pays to have a special man to take care of this business.

Theft of current from this class of business is much less than from the metered class. We prefer the use of special sockets and a fused service rather than the use of current limitors. We believe that it is not necessary to provide a flat-rate service for radios and other appliances, since the man who can own a radio can, if you have a proper residential rate, obtain metered service more economically than you can afford to sell on a flat-rate basis.

P. W. RAYMER,
General Commercial Superintendent.
Porto Rico Railway, Light & Power Company,
San Juan, P. R.

Grid-Controlled Rectifiers Supply Broadcasting Stations



A 520-kw., 20,000-volt metal-clad mercury-arc rectifier has recently been tested for over a year in the research laboratories of the German State postal authorities for supplying power to broadcasting stations. According to Nikolay von Kotschubey of Zurich, nine broadcasting stations in Germany are supplied with similar rectifiers and installations are planned or are being made in the Irish Free State, Switzerland, Poland and Hungary. Of special interest is the stability of these rectifiers on short circuit. By grid control it is reported possible to suppress output almost instantaneously when the delivered current rises above the allowable value.

Men of the Industry

Sporn Named Chief Engineer of American Gas & Electric

Philip Sporn, electrical engineer of the American Gas & Electric Company, has been appointed chief engineer in charge of both the electrical and mechanical engineering activities of the

company and its subsidiary companies. Mr. Sporn joined the engineering department of American Gas in 1920. As assistant to the electrical engineer he was associated in the extensive engineering and construction work on stations, substations, transmission lines and distribution systems involved in the development of the present extensive interconnected system of the company. From 1923 to 1927 Mr. Sporn was in direct charge of the engineering division of the electrical engineering and construction departments. In 1927 he was appointed chief electrical engineer in charge of all the activities of these departments and has been acting in that capacity up to the present.

Mr. Sporn has been active in the American Institute of Electrical Engineers, National Electric Light Association and Association of Edison Illuminating Companies as a member and chairman of many technical committees and subcommittees. He has presented a large number of papers before the American Institute of Electrical Engineers, of which he is a fellow. He is also a member of the Franklin Institute and a fellow of the American Association for the Advancement of Science.

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JOHN B. POSTON, vice-president and general manager of the Southern Ohio Electric Company, Columbus, has been appointed executive vice-president of the Columbus Railway, Power & Light Company. Mr. Poston, who has been a director of the Columbus company since 1930, will continue as vice-president of the Southern Ohio company, but will relinquish the duties of general manager. S. M. HAFFEY, chief engineer and general superintendent, will succeed Mr. Poston as general manager.

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FRED NORCROSS, manager of the Home Gas & Electric Company, Greeley, Colo., and president-elect of the Rocky Mountain Division of the National Electric Light Association, has been named to fill the unexpired term in that office of W. W. Nielsen, resigned. As a result of this choice of the executive committee Mr. Norcross will hold office approximately eighteen months instead of the customary year.

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WILLIAM A. KENNEDY, prominently associated with the electrical supply industry, has been appointed sales manager of the Royal Eastern Electrical Supply Company of New York, metropolitan distributor for the General Electric Company and other national manufacturers. Mr. Kennedy was for many years vice-president of the General Electric Supply Corporation in New York. He has always been closely identified with industry activities, being vice-president of the New York Electrical League and the Electrical Board of Trade of New York.

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OBITUARY

Edwin M. Herr

Edwin M. Herr, vice-chairman of the Westinghouse Electric & Manufacturing Company, whose death was announced in the December 31 issue of the ELECTRICAL WORLD, had achieved a notable place among the country's leading industrialists. His career was by no means meteoric, but was rather characterized by gradual and consistent growth from exceedingly humble beginnings. Born in Lancaster, Pa., in 1860, he moved to Denver, Colo., at an early age, and before completing his high school course became a telegraph messenger, later serving as telegraph operator and station agent for the Kansas Pacific Railway at Deer Trail in that same state. Continuing his studies while employed, he was able to enter Sheffield Scientific School of Yale University in 1881 and was graduated in 1884.

After obtaining practical experience with the Chicago, Burlington & Quincy Railroad at Aurora, Ill., the Chicago, Milwaukee & St. Paul Railroad and the Grant Locomotive Works in Chicago, he was named general manager of the Gibbs Electric Company of Milwaukee. In 1898 George Westinghouse asked him to accept the position of general manager of the Westinghouse Air Brake Company. Westinghouse and Herr had met in 1886 during a series of air brake tests conducted on the Burlington Railroad before the Master Car Builders' Association. In 1905 Mr. Herr was elected vice-president of the Westinghouse Electric & Manufacturing Company, served as one of the receivers of the company, and upon its reorganization, a year later, resumed his old position. He was made president in 1911.

Yale University and Franklin and Marshall College conferred honorary degrees upon him, and in 1920 he was decorated by the Emperor of Japan with the Order of the Rising Sun in recognition of his interest in training of Japanese students at the Westinghouse works and of the company's effective aid in the electrical development of Japan. He was always deeply interested in educational matters and devoted

much of his time to developing an educational system for the employees of his company. In 1920 he was elected a member of Yale Corporation and later was appointed to the prudential committee, in charge of financial matters connected with that university. He was also made a member of the corporation's committee on educational policy, on which committee he assisted in formulating the educational policy of the university, and particularly of the Sheffield Scientific School.

At the time of his death Mr. Herr was a director of the American Manufacturers' Export Association, the Radio Corporation of America, Westinghouse Air Brake Company and many other organizations.

John J. Carty

John J. Carty, telephone pioneer, whose death was announced in the December 31 issue of the ELECTRICAL WORLD, at an early age was fascinated by the possibilities of the telephone, which had recently been invented by Alexander Graham Bell, who was living

in Cambridge, Mass., Mr. Carty's native city. When an impairment of sight forced the discontinuance of his formal education, Mr. Carty entered the service of the Bell company in Boston and, with the exception of service in the U. S. Army during the World War, he had been with telephone companies in various parts of the country. In 1907 he was appointed chief engineer of the American Telephone & Telegraph Company, the parent company of the Bell System; in 1919 he was elected vice-president in charge of the department of development and research and four years later chairman of the board of directors of the Bell Telephone Laboratories, from which position he retired in 1930.

Mr. Carty's most notable achievement was the completion of the transcontinental telephone line which made possible the first transmission of speech between the Atlantic and Pacific Coasts, but he has to his credit many other attainments. Bancroft Gherardi once said: "To tell the story of his life and of his contributions is to tell a very large part of the scientific, technical and engineering development of the telephone art, not only in this country but for the whole world. . . . If we were to take out of the present telephone system those things which John J. Carty personally devised and contributed to the art, essential elements would have been removed and in many important respects the system would no longer be operative. . . ."

Among the scientific and engineering awards granted to Mr. Carty were the Edward Longstreth medal, 1903; Franklin medal, 1916; Edison medal, 1918; the John Fritz gold medal, 1928, not to mention the numerous honorary degrees which he received in the course of his career. He was a fellow and a past-president of the American Institute of Electrical Engineers, a fellow of the New York Academy of Sciences, past-president of the New York Electrical Society and a member of the Society for the Promotion of Engineering Education, the Franklin Institute, the American Association for the Advancement of Science, the American Physical Society and other scientific associations. He was director of telephone and telegraph communications in France for the American Army, leaving the service with the title of Colonel. He was buried with military honors in Arlington National Cemetery December 29.

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ALBERT N. CONNETT, well-known engineer, who designed and built at Washington in 1895 the first successfully operated electrical conduit street railway, died January 1, of arterio-sclerosis, at his home in New York after a brief illness. He was 73 years of age. A native of Bethel, Conn., and a graduate of Rensselaer Polytechnic Institute, Mr. Connett went to Paris in 1896 as chief engineer of the Thomson-Houston Company, designing and constructing many electric surface lines in France. Four years later he became chief engineer and managing director of J. G. White & Company, Ltd., of London and in this capacity designed and built water-power plants, electric light and power plants and electric surface lines in England, on the Continent and in South America and Australia. At the time of his death he was a director of the J. G. White Engineering Corporation of New York.

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CHARLES M. EINFELDT, a member of the Board of Water Commissioners, Denver, Colo., died December 17, in that city, in his seventy-first year. A graduate electrical engineer, Mr. Einfeldt had resided in Denver since 1889 and had taken a prominent part in business and civic affairs there.

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DAVID HARLOWE, at one time a member of the Wisconsin Railroad Commission, now the Public Service Commission, died December 13 at Milwaukee. Mr. Harlowe served as a commissioner for six years and in recent years had been senior investigator of the commission.

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New Equipment Available

Breaker With Oil-Filled Bushings

General Electric Company announces a new line of circuit breakers, rated 15, 25 and 34.5 kv. These breakers are equipped with oil-filled bushings of a new type which give the same efficient insulation and good service for potentials up to 34.5 kv. that higher-voltage oil-filled bushings have given in the past. By utilizing the oil-blast principle of circuit interruption the breakers operate in eight cycles. They are designated type FHKO-339, designed for indoor and outdoor service, and have interrupting ratings from 500,000 to 1,500,000 kva.

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A PORTABLE ELECTRIC HUMIDIFIER which works on the principle of internal evaporation is announced by the Westinghouse Electric & Manufacturing Company. All evaporation takes place inside the humidifier and no liquid water or free moisture comes out of the machine, consequently there is no light mist to damage or warp furniture or other objects in the room. Some of the features of this new humidifier are quietness of operation, the sound made being comparable to a Westinghouse 10-in. fan, and lightness in weight, and weighs but 20 lb. without water.

Midget Megger Tester

James G. Biddle Company, Philadelphia, has announced a new midget "Megger" tester as an addition to its well-known group of Megger insulation testing sets. Some of the characteristics of this instrument are its small (pocket) size and light weight. In common with other Megger instruments, the midget Megger tester consists of a true ohmmeter, direct-reading like a voltmeter, combined with a special d.c. hand gen-

erator. The scale reads as high as 20 megohms and the generator supplies testing current at 500 volts, thus obviating necessity for depending on batteries or any outside source of current.

Special spring plunger-type terminals for rapid attachment and disconnection are provided. There are no projecting or loose parts.